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August 1994

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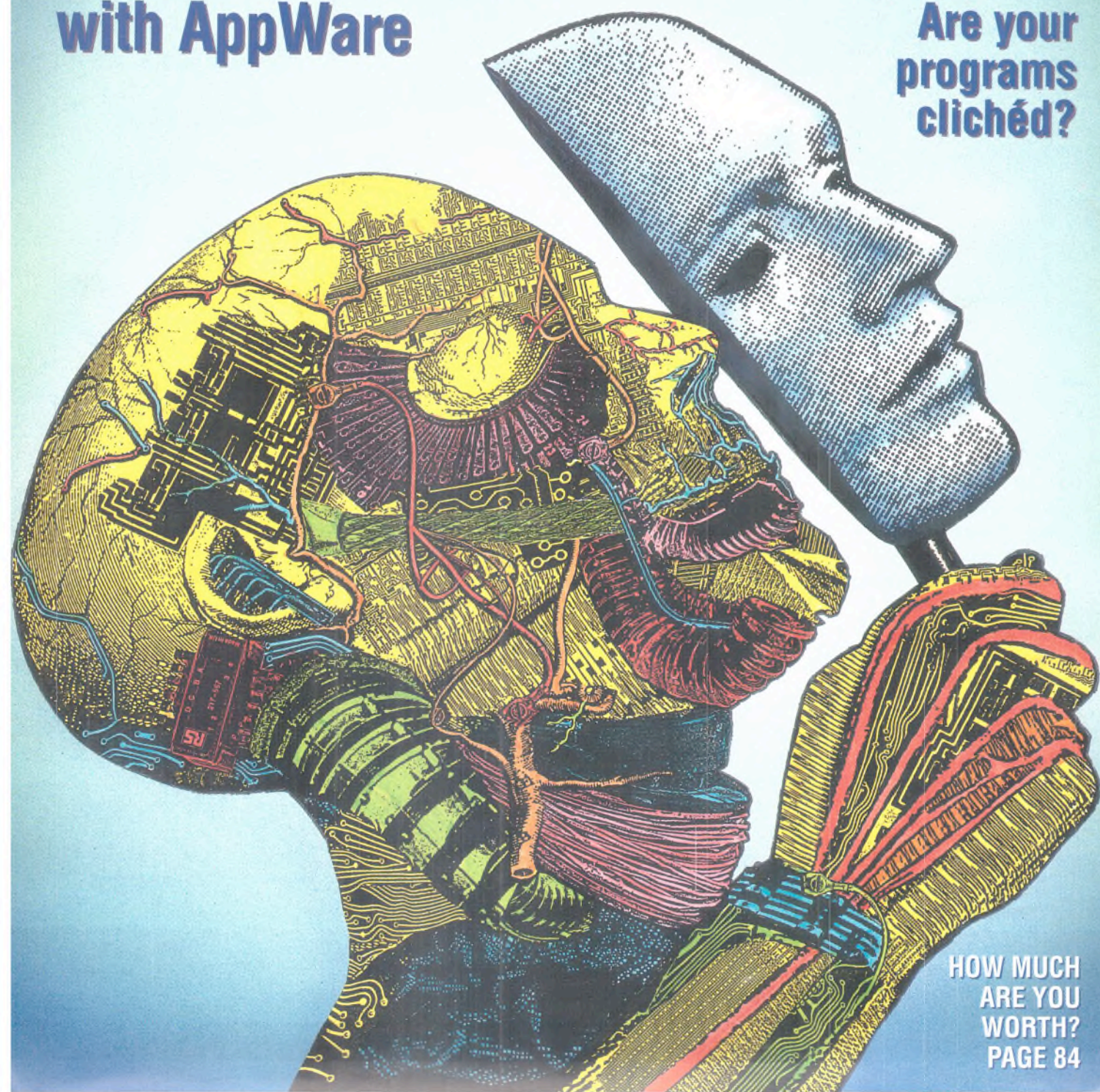
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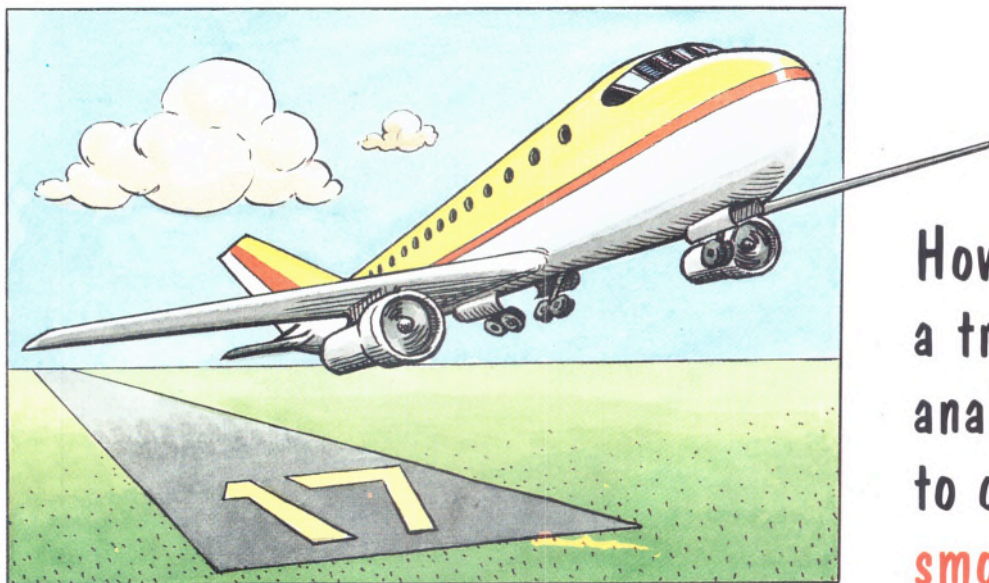
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**HOW MUCH
ARE YOU
WORTH?
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There are far better ways to spend one's time than wasting it travelling to and from work!

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Visual C++ 2.0, coming to a PC near you real soon. Lotus gracing the pages of EXE? We must be ViPs...



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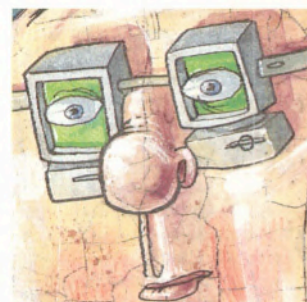
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Commuter heaven

When getting to work is more stressful than work itself, why go in the first place? Especially given that technology has advanced such that working from home is now a reality...



Consider the recent spate of rail strikes that have stretched our already strained transport system almost to breaking point. Roads not designed for the avalanche of would-be rail travellers became virtual carparks. People looked elsewhere for a means to get on with their day-to-day business: cycling, walking... The more resourceful even went as far as rollerblades to get themselves to their place of work. Inevitably though, some didn't bother and chose instead to bask in the glorious sunshine of the great British summer. But in the event of a major disruption to the transport infrastructure we cannot afford such luxury. We cannot afford to have our world stop simply because we are not physically at our place of work.

Now, more than ever, the public is being seduced by the wonders of the Internet and the information superhighway. Now is the time for the government to look seriously into how it can harness the power of what is rapidly becoming the communications revolution of the 90s. The Internet offers so much more than a mere messenger service. Notwithstanding the hype surrounding the entertainment potential of this new communications medium there are enumerable down-to-earth application areas currently under investigation. Already, companies are working on techniques such as electronic voice mail.

The impact of being connected to the Internet boils down to one fundamental factor, that being the ability to connect to any one of a million or more other computers on the net. Be they in the office next door or thousands of miles away. There is no reason why a PC at home couldn't connect to the office server, so long as both had access to the Internet. Such a connection could alleviate much of the congestion arising from failings in public transport. Office workers could probably get by with just a PC and a telephone. In fact, with the right equipment, there should be no reason why such people

would need to commute to work at all. There are some definite benefits to be reaped from working at home. The broad picture is that it puts less strain on the transport system. Less people on the roads; less people using public transport: those that do need to travel will do so with less delays to their journey times. For people working from home there is the added benefit of no travel time whatsoever. The hour lost commuting to and from work each day can be put to constructive use.

People who, for one reason or another are not able to commute to the office each morning would be able to earn a living from the comfort of their own home. The social impact would be enormous. Even in this, the so-called 'caring 90s', one of the cruellest barriers precluding disabled people from employment is effective transportation. Commuting to and from work can be the most stressful part of anyone's day. The same is true for expectant mothers or those with young children. Why must they endure the hassle of getting into work or finding a babysitter when they can work just as effectively from home?

The reason why the disabled are so often unable to work; mothers must choose between staying at home and leaving their children in the care of a stranger, and why people everywhere must struggle to get to work is the corporate mentality. The employer must be there, overseeing all that goes on in the company. Surely it's time for change?

For many people who work in computerised offices all it would take is a peripheral for receiving email from an external source, ie a modem with suitable comms software, a connection to the Internet and a strategy for sharing and distributing files. While it may be impractical to issue all employees with a PC for home use, companies should, at the very least, connect their office computers to the Internet. That way, the next time people can't get into work, some will still get by.

Cliff Saran



EXE: The Software Developers' Magazine is independent and not affiliated to any vendor of hardware, software or services. It is published by Process Communications Ltd, St Giles House, 50 Poland Street, London W1V 4AX.

EXE Advertising/Editorial/Production: 071 287 5000

Subscriptions: 071 287 5000 Ext 3142

Facsimile: 071 437 1350 **ISSN:** 0268-6872

Subscriptions. EXE is a monthly journal for software developers. It is available only by subscription, at a cost of £35 per annum (12 issues) in the UK, £56 for two years. European Community subscriptions cost £50 per annum, £80 for 2 years - Non-EC £70 1 year, £115 2 years. The magazine is published around the 1st of the month. To subscribe or if you have a subscription query, please call 071 287 5000 x3142, or write to The Subscriptions Manager, EXE, (address above). We can invoice your company if an official company order is provided, or take MasterCard, Access and VISA cards. Back issues are available at a cost of £3.50 each.

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News & Views

3D-Ware from Virtek

Have you ever fancied writing a full 3D game like TFX, X-Wing or F1GP? Or wanted to explore virtual reality but can't wait for those raytracing libraries to produce their output? Then call us now to get more information about 3D-Ware from Virtek - the FIRST AFFORDABLE REAL TIME VIRTUAL REALITY ENGINE. This is no hack - it is an enhanced version of the engine used in EPIC and TFX (winner of numerous recent awards). It is hand-crafted in assembler and uses integer arithmetic throughout for optimum speed. Most shapes will move and rotate smoothly on a 33 Mhz 386!

The high level API makes it surprisingly easy to write 3D apps. A visual World Editor lets you create and edit your virtual worlds interactively, and lets you walk or fly around them. There is also a Shape Editor for creating your own shapes, together with a library of over 500 shapes to start you off, including houses, trees, roads, cars, airplanes, spaceships, office furniture, etc. Or you can import DXF files from any 3D CAD package. Once you have designed your world and shapes, all your program does is move and zoom your camera, and move the shapes around your virtual world.

There are also many other functions to help in writing games and VR: 2D graphics for control panels and 2D games, palette control for special effects, mouse & joystick input, text output (in graphics mode), positioning functions (including fast integer square root), string manipulation, and file I/O (including PCX files). Resolution is the standard (for games) 320x200x256 colours and a Windows version is on its way. There will also be versions which support the Cirrus Logic 3D graphics accelerator when that appears later in the year.

You might expect to pay thousands of pounds for this library - instead Virtek are virtually giving it away for ONLY £99. Ninety nine pounds. It is also COMPLETELY ROYALTY FREE. Serious programmers should check out the PROFESSIONAL version which adds Gouraud shading, Texture mapping, autoscaling sprites, ellipses, and higher resolutions (up to 320x400). Write professional quality games and real-time VR apps for ONLY £249 with NO ROYALTIES.

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Lotusphere in '95

Don't miss Lotusphere '95, register now! The second annual worldwide technical and business conference from Lotus will be held in Orlando, Florida from the 22nd to the 26th of January '95. The conference will also incorporate Interchange, the annual cc:Mail user conference. Keynote presentations will be by Jim Manzi, John Landry and Ray Ozzie, the developer of Notes. More than 120 sessions are planned ranging from system planning to application development for Notes. If you develop software for a Lotus application you can also contact Lotus to show your products. Information on Lotusphere '95 can be obtained in the US on 0101 617 8945326.

SCO users meet

In June 40 SCO Unix users created the 'SCO UK User Group'. As with many user groups, its goal is twofold. First, it's a good place to exchange information and experiences about SCO Unix in particular and more generally about open systems. Second, it wants to act as a pressure group to give some input to SCO on future product directions. SCO's reaction is quite good: Bernard Hulme, MD and VP EMEA comments, 'SCO welcomes this move by the user base and we fully endorse the group.' To contact the SCO UK User Group call Christine Carter on 0923 816344.

Solaris on PowerPC

SunSoft and IBM have signed an agreement to port and distribute Solaris on IBM's PowerPC-based platforms. Solaris will be delivered either preloaded or on a CD-ROM. The version, that should be available in the first half of next year, will be compatible with Solaris 2.4 for SPARC and x86 systems (available this summer). In most cases, to port an application developers will only need to recompile it. At the beginning of October developers will be able to get hold of the Early Access Developer Kits for Solaris on PowerPC. SunSoft can be reached on 0494 472900 and IBM in the US on 0101 512 8382992.

Worse sales of DOS

The sales of software products in Western Europe for the first quarter, 1994 has gone up to \$522 million, an increase of 10%. As expected, only Windows applications continued to sell well, up 72% from Q1 '93. DOS fared extremely poorly, down 43% to \$52 million. And the Mac was down too by 9% to \$30.7 million. UK/Ireland were the biggest spenders this quarter.

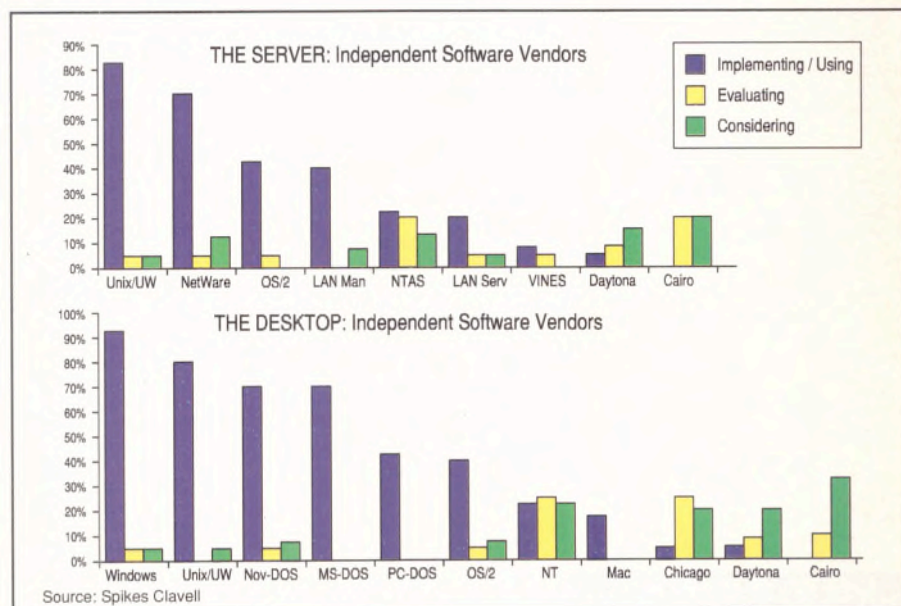
Confused 'bout Microsoft?

Recent market research conducted by Spikes Cavell shows a certain confusion in the perception of Microsoft's operating systems. Everyone seems clear about Windows, presumably since it has a penetration of over 80% of the PC OS market. But the situation is not the same with regard to NT, Daytona, Chicago and Cairo. Respondents were aware of the code names but 'many could not remember which product was which'. Users had the impression that NT and NT AS were the same thing. Spike Cavell cites one possible reason as being the fact that MS 'fails to give any kind of straightforward definition of the NT Advanced Server Platform'. The confusion is likely to increase with the recent renaming of Windows NT to Windows NT Workstation and Windows NT Server.

Not surprisingly, 93% of ISVs said they were using Windows as their main platform but when it came to NT, the figure dwindled to 23%. On the income side, only 63% of ISVs mentioned Windows as their most important revenue generating platform now, while 40% thought that this would still be the case in two years time. It is probable, however, that they will have moved to NT, Chicago, Daytona maybe even Cairo. MS appears to be winning as the desktop OS for both users and ISVs over the next two years, but it is not clear with which of their OSs.

On the server side, for ISVs, UnixWare is a clear first followed by NetWare. The use of UnixWare by ISVs, according to the survey, will increase in the next two years. The only MS server platform which more than 10% of ISVs say they will be using in two years is NT Advanced Server, *not* Daytona as might have been expected. In the case of users though, 95% of the respondents were using NetWare on their server.

For more information on this research, contact Spikes Cavell on 0635 550449.



Usage and plans for the desktop and server amongst ISVs

Just say the word

WordPerfect has formed an alliance to develop a speech recognition API for Windows. Companies participating in the initiative include IBM, Novell and Phillips Dictation Systems. Notable by its absence is, of course, Microsoft. The aim is to integrate speech seamlessly into Windows applications. 'When vendors truly commit to writing to open standards, the issues of compatibility and interoperability will disappear...' explained Mark Calkins, vice president of products and strategic marketing at WordPerfect. No guesses as to which vendor he implicitly refers to...

The goals are certainly high: support for discrete *and* continuous dictation for input of text and data. WordPerfect will offer the API as part of its PerfectFit technology which lies at the heart of all its software products. Developers will get access to the Speech API via the PerfectFit SDK. WordPerfect expects the API to be included in PerfectFit SDK in the fourth quarter 1994. The company itself will begin shipping speech aware applications in early 1995. Other participating companies have announced their intention to have products compliant with the speech recognition API within a year.

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Challenging stuff

The closing date for entries to the fourth Business Software Challenge Award is September 2nd 1994. The competition, sponsored and funded by Computer Associates, has attracted interest from a number of UK colleges. Prizes to the value of £20,000 are being offered. Judges will be looking for entries which are of original software design and meet identified business needs. Students wishing to enter should submit suitable projects to the Competition Secretary, PO Box 2ER, London W1A 2ER.

DEC to support NeXT

NeXT has announced that DEC will be the third major (but for how long?) partner to adopt OpenStep which will result in OpenStep being ported to DEC's OSF/1. Workspace Manager, NeXTmail and NeXTstep Developer will be available on DEC hardware. Developers writing to the OpenStep API will be able to move to PA-Risc, SPARC, Alpha and PowerPC based systems. It is also expected that DEC will integrate OpenStep with ObjectBroker, its CORBA compliant distributed object request broker, allowing interaction between ObjectBroker and NeXTstep.

HP takes UnixWare front seat

HP has joined the UnixWare Technology Group (UTG) as a sponsor member. UTG was established in May 1994 as a non profit making organisation for the advancement of UnixWare. Being a sponsor member it will also be on the Board of Directors and so can influence the direction of UnixWare. HP is interested in working with other UTG members on advanced OS technology, systems management, object and integration with DCE. Previously HP has worked with Novell, along with several other companies to define SPEC 1170 and the common desktop environment.

Networks developments

Were you at Networks '94? It was much bigger than the previous year. Three halls instead of one. Not to mention fancier stands. To find interesting ones, Blenheim, the organiser planned 'product trail' guides. So you were able to find everything about ATM, FDDI or system integration... But what about software developers? No trail guide for them. Just a few products hidden amongst all the end-user and MIS stuff. How do they all develop these wonderful network products? Maybe everything was hidden in the big red box where no one but Novell employees dared to walk in...

OpenDoc on OS/2

At PC Expo, Big Blue demonstrated OpenDoc on OS/2. Since the show, the alpha code has been made available to developers as part of the IBM PSP Developer Connection CD-ROM. Apple was the first company to release OpenDoc code to developers (see EXE July '94). After the Macintosh and the OS/2 platforms, the next code release should be for Windows; Novell (with WordPerfect) has the responsibility for the Windows version. A Unix version is also in the pipeline.

Reference source code for OpenDoc and validation suite to test the OpenDoc compliance will be provided to system vendors and developers by a non-profit association, the Component Integration Laboratories. The CI Lab was founded last year by Apple, IBM, Novell, Taligent, WordPerfect and Xerox. Its initial goal is to offer to its members the control of the evolution of the family of technologies involved in OpenDoc.

Beside the OpenDoc core itself, which is in charge of the integration of the software components, four other technologies are part of the family. Big Blue contributed its System Object Model (SOM) while Apple provided the Bento object storage and the Open Scripting Architecture (OSA). The fifth technology, the OLE 2.0 adapter, enables interoperability with MS OLE. This adapter is intended to attract OLE developers, so that OLE compliant applications in the future will be developed with OpenDoc. We'll have to wait to see if it's really much simpler to program for OpenDoc than for OLE2... Currently the different libraries composing the OpenDoc family are available directly from their developers. But as soon as the code is completed, the source will be transferred to the CI Lab. Developers can get hold of the code by calling IBM Software on 0329 242728 or obtain more information from the CI Lab in the US on 0101 415 7508352. ODBC for Informix

ODBC for Informix

At the beginning of July, Informix Software and Visigenic Software (see EXE March '94, p14) entered into a technology licensing agreement regarding multi-database connectivity. Informix will get Windows and Unix ODBC drivers for Sybase and Oracle databases as well as for its own. Visigenic's ODBC technology will also be used to provide a Call Level Interface (CLI).

With the integration of a CLI standard interface, Informix' developers will no longer need an embedded SQL precompiler to access databases. Visigenic is porting the MS ODBC SDK to Unix, OS/2 and Mac platforms. Visigenic ODBC SDK costs \$995 per seat; for Sun and soon for HP and IBM. The ODBC drivers will be available in October. Visigenic can be reached in the US on 0101 415 2861900.

MS and Stac settle

The legal saga between MS and Stac has come to an end. For those who have not followed the story closely, here's what happened. On the 23rd of February, the jury awarded \$120 million in damages to Stac for software patent infringement. MS was found to have infringed two of Stac's patent in the DoubleSpace disc compression utility. At the same trial, the jury awarded MS approximately \$13.6 million in 'damages for misappropriation of trade secrets'. That was of quite serious concern for developers as it meant that any company using a non publicly documented API of Windows could also be sued by MS.

On the 8th of June, the Court of California issued a permanent injunction to restrain MS from 'making, using, or selling' all the products using the relevant disk compression code including MS-DOS 6.0 and 6.2, NT-AS and FFS. Only the OEMs who had a previous agreement with Stac; Compaq and IBM, were not affected by this injunction. On the 20th of June, Big Blue decided to cash in on this by announcing a price reduction on PC-DOS 6.3 that included, legally, a disk compression utility.

But the next day, the 21st of June, MS and Stac settled their patent dispute with a 'broad cross licence agreement'. It covers all their existing disk compression patents as well as any new ones received in the next five years. The agreement looks like a good bargain for Stac. MS will pay a royalty for the use of Stac's patent. MS will also give Stac access to its preload technology. But that's not all, MS will pay Stac royalties of \$1 million per month for 43 months! Lastly, MS will purchase \$39.9 million of 4% non-voting stock. The saga finally ends happily for both parties, but the issue regarding the use of a non documented API is still no clearer.

WINDOWS

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Another dBASE for DOS!

What's Borland playing at? dBASE 5 for DOS? Surely not; so soon after the debut of dBASE 5 for Windows. It shares most of the features of its Windows counterpart (see EXE July '94) including the new OO extensions to the language. Performance has increased thanks to a 32-bit compiler and the interface is now event driven and can be designed visually (but is still in character mode). However, even with all the changes, the Control Centre remains. dBASE 5 costs £499 new and £99 as an upgrade. For comparison the price of dBASE 5 for Windows is £349... Borland is on 0734 321150.

Windows snooping

WinScope V1.2 now offers a knowledge base of over 2,000 APIs. These can be used in conjunction with a new 'enhanced event capture' facility to monitor and debug software that makes almost any system call, from the Windows APIs to system drivers and new APIs such as TAPI and OLE 2. It can also capture all Windows messages and exception interrupts. Other features include the ability for any application to place text, interrupt, stack trace and register information in the WinScope trace buffer and a trace file. WinScope costs \$149 from Periscope Company (0101 404 8885335).

Client/Server in two steps

Trinzic has launched ObjectPro, a two-step Client/Server development tool. The prototyping phase is done in an interpreted 4 GL object oriented environment. Then the code of the application is generated as DLLs in ANSI C. All components are stored as objects, so new business objects can inherit from previously created ones. ObjectPro costs \$2,995. Trinzic is on 0923 816236.

Get installing

UK developers can now get hold of PC-Install, an installation program toolkit which can also be used to install software upgrades. PC-Install can determine the processor of the target machine, the free disk space, etc and modify AUTOEXEC.BAT, CONFIG.SYS and even WIN.INI in the Windows version. An optional PC-Shrink package features automatic compression and decompression of the files. The DOS and Windows versions plus a combined package that includes PC-Shrink are available from Foxware on 0277 264422, Grey Matter on 0364 654100 and System Science on 071 833 1022.

No sell from date...

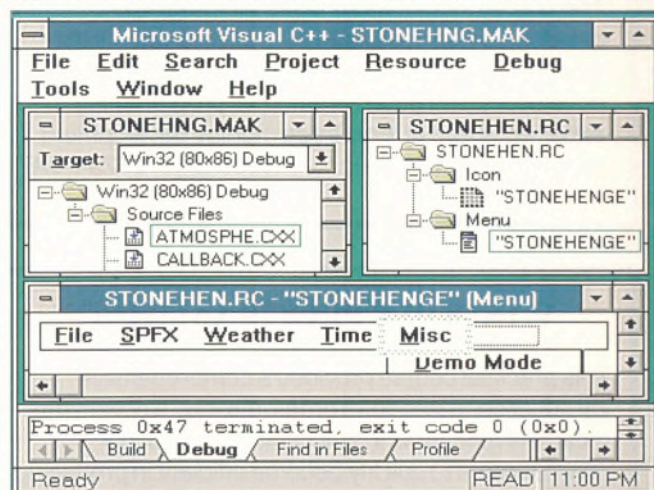
It's almost here. The newest (and greatest according to Microsoft) release of Visual C++ is due out any day now. The new 32-bit compiler language system will be hosted under Win32 on Intel and MIPS platforms when it is released. Microsoft says the DEC Alpha version will be ready in the fourth quarter. However, the Win32 platform will not be NT 3.1 as VC++ 2.0 supports OLE, a feature that is only available in the Windows 3.5 'Daytona' release of NT. Roll on Daytona... Of course, being based on Win32, Chicago will also be an available platform. Roll on Chicago. Hmmn, I think not: not yet anyway.

As well as being available as a native application for Intel, MIPS and Alpha, VC++ 2.0 will be able to target the Macintosh through an add-on to the Intel edition. The Win32s library has been ported to the Macintosh, providing a direct mapping onto the System 7 API, allowing both MFC and Win32 based applications to be ported to the Mac. Microsoft promises that targetting of 68K Macs will be available immediately on release of the Intel version. PowerMacs are in the pipeline... Applications targetting the Mac are written, compiled and linked on NT. The executable code is then squirted down a serial line into the Mac. Remote debugging is available from within the VC++ IDE across a network or serial connection. True MacHeads everywhere will be disappointed though: ugly Windows droppings defacing the oh-so-pure Mac UI (such as Excel style toolbars), can now be created by anyone, not just MS.

Apart from the obvious cross-platform availability, VC++ 2.0 offers an improved IDE with customisable toolbars, dockable windows and a new hierarchical Project browsing window. MS has finally dropped the separate App Studio application: now it's built into the environment. Infamous for its slow compilation, MS now offers two ways to speed up the process. First, the Browser can be built 'on demand' rather than for every compile. And second, the linker is now incremental. With these, MS aims to reduce link time to around 10 seconds.

MFC has been optimised and enhanced with support for 32-bit OLE and ODBC which is available on all platforms. The Wizards for OLE/ODBC from VC++ 1.5 are now available for the 32-bit APIs. Further optimisations include a technique that MS calls Opt++ which it says will remove the performance penalties of C++.

Finally, the compiler has caught up with the rest: it too supports templates and exception handling. Prices for VC++ were unavailable at the time of going to press. For further information phone Microsoft on 0734 270000.



VC++ gets a hot new IDE

VB developers tool up

Tools v1.0 from The MandleBrot Set (TMS) is a new development aid for Visual Basic programmers which offers a set of programming utilities and source code modules. The utilities are launched from a toolbar which bears a striking resemblance to that of MS Office. It too provides a Tools help facility and is configurable. AutoCoder is the primary programming aid of Tools. It's a kind of macro expander that allows programmers to create reusable template subroutines and functions that can be loaded into a VBW source code module. AutoCoder can be configured to slot in the template using a programmer-supplied function name. Another utility, Resource Gauge, helps VBW developers keep track of how much system resources their applications are consuming. This can be used as a guide to the relative responsiveness of the application on a user machine. There is also a tool for unloading DLLs which are left in memory when a program crashes, a custom control for accessing INI files and a program tracer that presents a call tree representation of the running program with the time each function was called. The complete toolkit is priced at £99. TMS is on 0941 117534.



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NOVELL The Past, Present and Future of Network Computing

NextStep becomes more PC

Release 3.3 of NextStep is expected out by the end of the year. What's more, you may already have a PC that will accept it. New drivers have been added to support more Intel compatible systems. Also, NextStep will support hardware standards such as PCI, ISA Plug & Play, PCMCIA and software ones like MIME. NextStep will include version 4.0 of Insignia's SoftPC. It will also have NetInfo, a Client/Server object model which allows transparent messaging to occur between local and remote objects. NeXT Computer can be contacted on 081 565 0005.

Middleware from Big Blue

The latest addition to IBM's Application Productivity Family is called VisualGen, a software tool which manages to encompass many of today's trendy buzzwords: 'visual', '4GL', 'middleware', 'rightsizing', 'Client/Server'. It's got 'em all. In effect it is a 4GL application generator that works on OS/2 2.1 and generates either OS/2 or Windows 3.1 clients and servers for MVS, VSE or OS/2. VisualGen Developer costs £2,636; the VisualGen Generator is £10,000 for MVS and £8,300 for VSE; there's an additional £942 for the workgroup services. IBM Software is on 0329 242728.

Prolog on Mac

LPA has announced a range of Prolog software tools for the Mac. The main one, MacProlog32 is a 32-bit Prolog incremental compiler completely integrated in the Mac environment. The LPA tool also includes Prolog++/MacObject, an object oriented Prolog with a graphical programming environment; and a few other add-on tools. MacProlog32 costs £1,495 with a run time generator and £745 without. LPA is on 081 871 2016.

Out of sight

If you're paranoid about the secrets held in your computer or just want to conceal your PC, two companies are announcing the desk you've been dreaming of. Portasilo has managed to put a desk in a 'high security cabinet' with features such as 'multi-point locking'. But if hiding your PC away from view is enough to calm you down then Padek's solution may be more to your liking. A uniquely crafted sideboard which 'at the touch of a button on the remote control' opens itself to reveal a complete working environment. Portasilo can be reached on 0904 611501 and Padek on 0425 471564.

Object Server and Broker C++ Extensions

Ilog has introduced a set of extensions to the C++ language: an object server and a broker. The object server is based on the Smalltalk Model-View-Controller architecture so objects can be accessed simultaneously by multiple users. Each user can interact with a different representation of the same object. The consistency of the views is guaranteed by the server. Furthermore, the architecture of the Ilog server enables an object server to be distributed in a transparent way.

The first step is to design statically an object model by annotating C++ objects using the 15 or so predefined keywords. The Ilog server enables you to create a dynamic object server. A new client or object functionality can be added without touching the source of other clients. The separation of the object server from its clients and of the application from its interface is obtained through the use of notifications and logical views classes. The contextual notifications allow a client to act on and be notified by the server within its logical view class. To distribute an object server, the only necessary modification is to make the notification mechanism asynchronous.

The Ilog Broker is a light distributed programming tool that provides peer to peer communication between objects. It is aimed at C++ developers wanting to write a distributed application without having to learn a new language. With a single API, it is possible to port an application across heterogeneous platforms such as Sun OS, Solaris, HP or DEC Alpha. The broker generates transparently the communication protocol (based on RPC). It includes security features, like automatic detection and notification of network breakdowns.

Both tools include a C++ preprocessor and a set of libraries. The Broker and the Server cost £3,400 and £2,800 respectively and are available for the Digital, Hewlett-Packard and Sun flavours of Unix. Ilog can be contacted on 0483 440388.

No more bugs for Clipper

If you're a Clipper developer and hate debugging, Scrutiny is the right tool for you, at least according to QBS Software. Bugs are found by checking for assertion violation, so all you have to do is to include assertion statements in your code describing what you expect. The assertions are logical statements expressing the assumptions made in the coding. For example type checking can be done automatically if you chose variable names according to the Hungarian notation. Since assertions are checked when they are read inside a routine, they can help detect an error before it propagates elsewhere in the program. An added benefit of including assertion statements in your code is that you document it at the same time, notably by describing all parameters of routines and expected results. Scrutiny cost £199 and is distributed by QBS Software (081 9944842).

ViP take Notes

At Networks 94, Lotus previewed ViP, a Windows visual programming tool for developing Notes applications. ViP application can access both Notes and SQL databases. Data stored in Notes either locally or on a Notes server, are accessed directly from ViP; other databases can be accessed through Lotus DataLens for Windows or the new NotesSQL. The NotesSQL driver (which is free) provides an ANSI SQL link between Notes and other applications. It allows ODBC compliant Windows applications to access data stored in Notes.

ViP is composed of a designer and a runtime environment, the latter of which will be distributed free of charge to all licensed workstations. It includes LotusScript 2.0, a Basic compatible language augmented to support events. The environment can be extended with what Lotus has called DTx for Designer Tool Extension. ViP should have some degree of compatibility with Visual Basic, but at the time of writing no definite information was available. It is probable, but not yet certain, that ViP will accept VBx's. If this is not the case, then VB/Link for Lotus Notes from Brainstorm might attract more developers than Lotus' own tool: Brainstorm's product is purely a custom control for VB to access information stored in Notes.

For more information on ViP or the Recognised Professional Developer programme, Lotus Development can be contacted on 0784 455445. Doran Essen, Brainstorm's distributor, is on 071 637 2140.

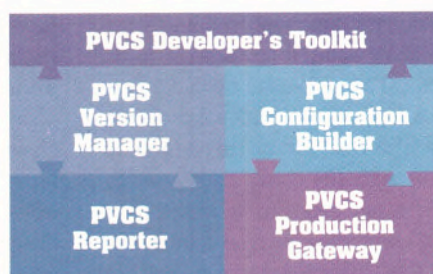


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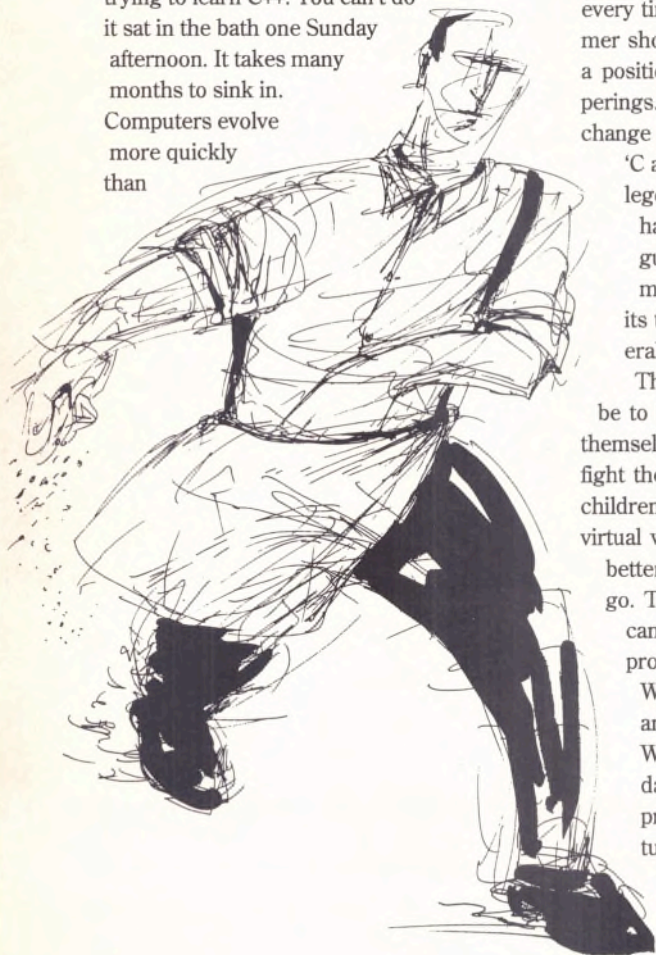
Rubbishing C++ is one sure way to court disaster. Kevin Yeandel rejects the western way...



Inability to comprehend important concepts supporting the existence of C++ (or any object language for that matter) often leads people to make aggressive and profound statements attacking it.

Pascal, like every language, has its place, as does OT (Object Technology). The higher the generation of language, the more restrictions. Pascal has more restrictions than C - mainly through compiler/linker design but remains an excellent teaching language. Nevertheless, the closer you get to machine code the more you can do and the faster you can go. The price for this, however, is reduced code comprehension.

I was no different from the next person trying to learn C++. You can't do it sat in the bath one Sunday afternoon. It takes many months to sink in. Computers evolve more quickly than



our organic brains. Your customer knows they get faster and bigger, he expects *you* to utilise these technological advances in your programs and doesn't care how you do it. IT accelerates, projects grow and comprehension reduces. We must have a solution which aids understanding. 'Objectification' is a natural way of dealing with real world situations. It's not unreasonable to predict that in many cases, companies using OT will reward their shareholders with increased dividends while companies sporting Victorian attitudes fade away into oblivion.

If you don't want to put the world to rights or write programs with more than 10 lines then stick with Pascal because you won't have to use OT. I don't have to use Pascal but I don't rip it to shreds for the simple reason that I understand both and prefer OT because it suits my requirements. Don't fault what you don't understand. Careless talk costs.

OT-phobic programmers get a little buzz when they show anti-OT propaganda to an experienced OT user. We fall behind a little every time a frightened traditional programmer shows 'The Director' or anyone else in a position of authority these Luddite whispirings. It's in our genes to be reluctant to change and comforting to read quotes like 'C and C++ Going Nowhere'. A local college lecturer recently told me that C++ had no future and Basic was the in language. This attitude, like that of so many colleges, is six years behind in its thinking. Which is fine because generally, so is British industry.

The basic human desire must surely be to build machines which can think for themselves, carry out domestic chores and fight the battles of everyday life. To let our children enjoy, experiment and learn in a virtual world while we make the real one a better, safer place. We've a long way to go. There is an infinite list of ideas. We can learn from our mistakes in war and protect ourselves from future attack.

We can study the ecology of the world and assess a plan for future survival. We can limit the number of essential dangerous experiments for example, preventing death by learning to fly virtual aircraft.

We have to find a way to model these super projects. Those of us who are not God or have an IQ under 200 will not be able to

do it using Turbo Pascal or C. This is not to say C++ alone is the be all and end all. But it is a tool highly suited to development of the complex neural networks and cognitive maps which most people in the UK and USA are shielded from, unaware of.

The computer I used 14 years ago may have had 16,000 times less memory than this but both have an IQ equal to that of a modern day super computer - zero. This missing IQ is the contraceptive preventing the current primitive IT infrastructure giving birth to a crime free world of super safe self driving vehicles and Governments making decisions for the right reasons instead of through deceit and for personal gains. This technology is just around the corner. However, if *you* didn't have sushi this week, if you're not living in Japan or Korea, you may not have heard of it. Neural networks (adaptive fuzzy systems) *will* give machines the IQ needed to fulfil our dreams. We'll have a reason to keep bringing children into this world.

Maybe 'electronic' natural selection will choose to render our Aristotelian based processes extinct. Why? Because some idiot will show a letter or article in a magazine dismissing Fuzzy Logic which, while carrying a miniscule weight will be sufficient enough to sway a decision by a US computer manufacturer that 'perhaps we should rethink this fuzzy approach and let someone else risk the money first...' Too damn late. The gross national debt of America (at time of writing increasing by \$20,000/second) overtakes the gross national product and there's not enough money in the kitty for a Dunkin Donut. The Americans probably wouldn't even see the attack: 'Too busy watching the game'.

This is a real problem - not a laughing matter. One which needs to be dealt with. Western industry needs to open its eyes to global IT. So where does this leave us? No one person can do this alone, but through the eyes of the media could this country be enlightened to what's actually going on? Yes it can. We need more people to speak out - to sow the seeds of information. Not just to grab the attention of the minority of people in the IT driving seat but, as a bonus, to sprout an interest for the rest of us *then* the seeds will bear fruit. There *is* more to programming a computer than just sitting in front of one. ■

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Comparing Object Oriented and Relational Design Methodologies

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Storing Objects	As Objects	Break Objects into Tables
Database Model	User Application Model	Separate Database Model Required
C++ Integration	Total	Poor
Database Operations	At Object Level	Must Write Code
Productivity	Increased	Reduced
Complex Object Performance	Excellent	Poor

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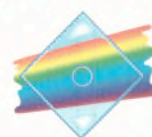
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AppWare - behind the veil

Novell has been working for over a year on an architecture and tools for multi-platform development. **David Mery** unravels the truth from the hype.



One of the biggest problem facing software developers today is the number of APIs they have to learn. The problem is even worse for the companies that create products for multiple platforms. The ultimate dream of every software house is to develop an application on one platform that can be executed on many, and that will evolve easily with new releases of OS or new network protocols. The obvious advantages would be cost reduction and an overall faster deployment of the application. Could the AppWare offering from Novell be a step in both these directions?

Saint Novell?

AppWare is based on a software layer that isolates applications from the OS and networking services. When using AppWare, application developers do not need to learn any specific OS, GUI or network API, instead they develop for AppWare. In other words, AppWare helps the developer to write network aware software as opposed to NetWare aware software. So, what's the catch? Novell claims that there are too few networking applications and that any increase in numbers is therefore a positive move, even if this results in a profit to its

competitors. Of course, Novell will be collecting a tidy profit along the way too, but nobody ever said that the path to righteousness was easy! Neither will it do Novell any harm to try bringing its two very different product lines, Unix and NetWare, together.

According to Novell, AppWare's mission is 'to empower developers to build better networked applications, faster, on multiple platforms... It will do for a network application what OS did for desktop applications', that is to provide the same sort of independence from the OS that the OS themselves provide from the hardware (see Figure 1). It sounds like a revolution theme, we'll have to wait and see if developers will march along... The AppWare term was coined by Novell to name an architecture and several different development tools. The two major products: AppWare Foundation and Visual AppBuilder, were initially developed by two different companies (Software Transformation Inc. and Serius Corp. respectively), both bought by Novell.

Solutions? But not oil and water

Some solutions have been implemented to solve the usual problems associated with layered approaches. Most of the compo-

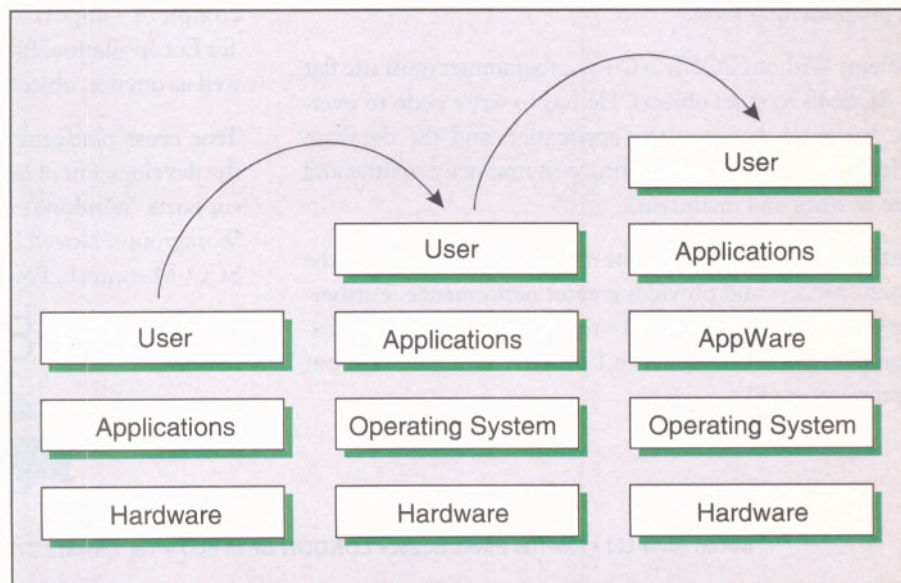
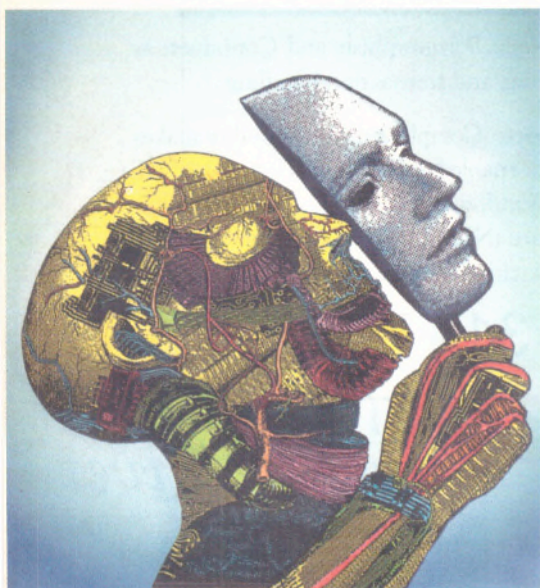


Figure 1 - Following the evolution of computing models

nents have two parts: basic objects which support the subset of the common features of the different supported platforms and extended objects which offer some advanced features not always present in one or more of the platforms. For example the basic text object is limited to 32,000 characters (Macintosh limitation) and only one font (Windows limitation), but the extended text object does not have any of these limitations. So developers can choose the object best fitted to their application with minimum performance penalty, and without being limited by a minimum common subset attitude. This scalability of AppWare is also used to extend client OS functionalities. For example, the child windows implementation found in Windows is supported on Unix clients, in the same way the limited Unix print functionality has been extended to provide a full printing model.

Try for a hatrick

The goal of AppWare is to hide the complexity of the many APIs involved in cross platform and networking applications development without performance degradation. All the functions in AppWare have been developed in native code. Which means AppWare applications can run as efficiently as native applications. This also brings some additional benefits: AppWare applications have the look and feel of the platforms on which they are run. Furthermore, it's possible to port existing applications incrementally to AppWare.

Novell sees three main benefits to be gained from using AppWare. The first is that the tools available simplify developers work by offering an API richer than the combination of underlying APIs. There are tools for 3GL developers, for tool makers and for high level application designers. The second is that productivity is increased

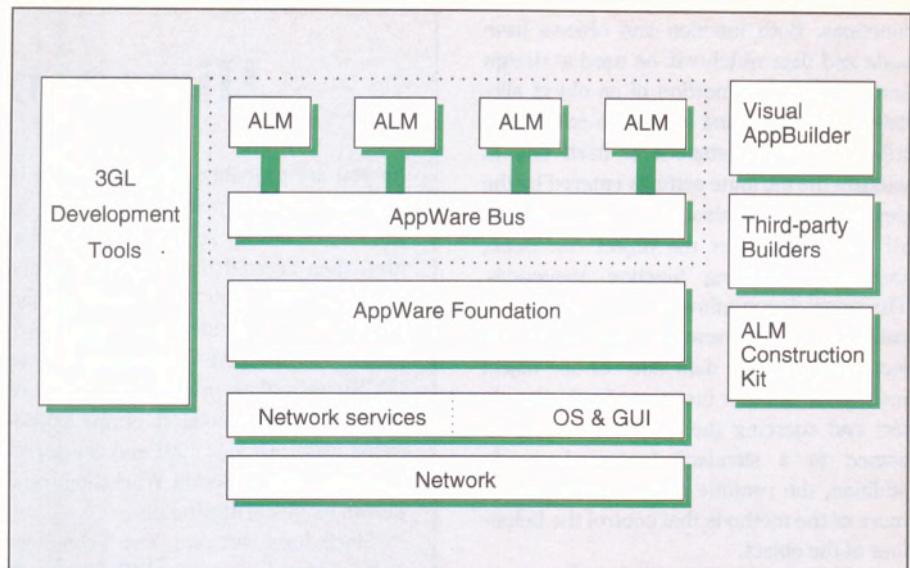


Figure 2 - AppWare architecture

by making applications easier to port to multiple platform. The applications are portable to all the architectures supported by AppWare with a simple recompilation. Applications are coded for the AppWare API and can then be compiled and run on a Unix box, a Mac or a Windows computer. Finally, says Novell, AppWare enables applications to make full use of network services without having to delve into the numerous network APIs.

AppWare's underware

As can be seen in Figure 2, AppWare consists of a layered architecture. The first block, the AppWare Foundation is composed of a collection of software modules, mainly native libraries. The Foundation provides an interface to access the OS, user interface and connectivity services. Applications can be developed directly for the Foundation with a 3GL. All components of the Foundation are grouped into three series:

- The OS Series comprises services such as memory management, data management, file management, font selection, application internationalisation and device management, see Figure 4.
- The User Interface Series supports MS Windows, Macintosh and Motif on Unix. It provides a basic Dialog Component to support most of the modal dialogs found in applications such as error message windows. There are also the usual menu types and built-in controls for windows, edit text areas, display areas, lists, sliders, tables... All the controls can be nested.
- The Network Connectivity Series provides inter and intra application connectivity and communication facilities through named pipes, sockets, messages, OLE, Apple Edition Manager and clipboard management (see Figure 5).

On the buses

The next layer, the AppWare Bus, is a software bus for managing large-grained, interchangeable components called AppWare Loadable Modules or ALMs. An ALM can be as simple as a button control or as complex as a full spreadsheet module. The two functions of the Bus enable the creation of ALMs and provide tools to access ALMs. To compose a complete executable program, an application designer has simply to link ALMs with an AppWare Bus compatible tool such as Visual AppBuilder.

An ALM is made up of two software components: objects and functions (see Figure 3). These are further divided into those which are accessible at run time and those restricted to design time. Simple ALMs usually consist of one object and several related

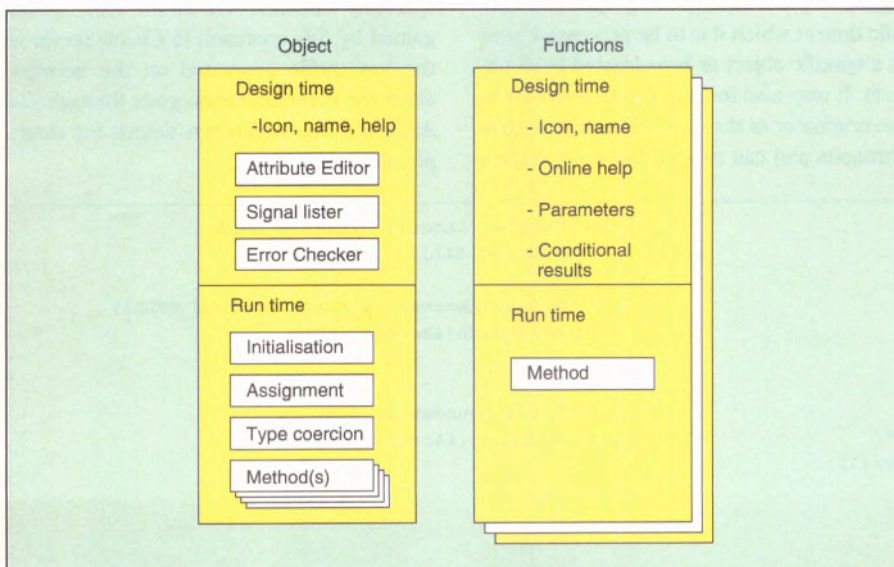


Figure 3 - Architecture of a simple ALM

functions. Both function and objects have code and data which will be used at design and runtime. The portion of an object allocated to design must be able to edit the attributes of the instances of itself and to validate the attribute settings entered by the designer. It must also give a description of all the signals that the object can issue, therefore triggering function sequences. The remaining runtime portion must be capable of creating new instances of the object, assigning any data value of one object instance to another instance of a similar object and coercing the data value of an instance to a standard textual form. In addition, the runtime portion holds one or more of the methods that control the behaviour of the object.

You'll be relieved to hear that the structure of a function is considerably simpler. Functions contain mainly data such as the required parameters and a list of the conditional results (for example, the Windows **Open** function has two conditional results: open and not open). The runtime part of a function will include the method that is executed when the function is called.

The ALMs can be developed either in native, or portable code with AppWare Foundation. Since the Foundation is a relatively new product, all Novell's current ALMs were written in native code. At present Novell is not charging royalties for its ALMs, whether other companies will choose this policy remains to be seen. The code of an ALM has to conform to the AppWare Bus Module Interface in order to be controlled by application designers at design time and to communicate with each other at runtime. Several subsystems of the AppWare Bus are available to ALM developers. There's a Querying Engine which allows objects to call other objects' functions in a completely transparent way to the application designer. More specifically, the Querying Engine provides detailed information about each object and function of an ALM. For instance one object can ask for the list of all the other objects and functions present on the Bus, their names and icons, in-

History of AppWare

As you are probably aware AppWare is not the unique creation of Novell. In June 1993, Novell acquired two companies, then created the Novell AppWare System Group. Software Transformation Inc. (STI) was founded in 1987 and provided the Universal Component System (UCS) technology which is the base of the AppWare Foundation. Serius Corporation was created in 1991 and developed a product called Serius Workshop, now known as Visual AppBuilder.

Since June last year, the technology and products have evolved. The main additions to the UCS technology were the support of the CPI-C interfaces for host

connectivity, Apple's Compound Document Architecture and MS OLE. Planned enhancements are the X/Open distributed transactions processing APIs supported by Tuxedo and the support of OpenDoc.

Some of the current users of AppWare have been using the technologies since well before June 1993: mainly US companies like Elly Lily, Hyper Active, KPMG, Atlas and also the State of Utah! Atlas, for example, has developed a graphical information system for building companies, where the items can be selected with a light pen and the cost evaluated.

formation regarding their parameters, conditional results and type checking, their on-line help etc. The Bus also includes some routines to instantiate objects as well as others to invoke object attribute editors of referenced objects.

The bus conductor

The most important component of the AppWare Bus is the event engine which manages and coordinates interactions between ALMs at runtime. It controls the invocation of the object's methods by events. The AppWare Bus has several predefined events, such as start-up or change broadcast, to which an object can respond. An object may also have its own set of events, which it can send to, and receive from, other compliant objects. The event engine provides communication between ALMs in a flexible way. An event can either be assigned a processing priority; given a specific time at which it is to be processed, sent to a specific object or broadcasted to all objects. It may also include a return receipt to the originator of the event. Events are asynchronous and can require the event engine

to discard all duplicate or similar events in the event queue when a new event is inserted. This engine is more than just an event processor it can act on its events queue.

The AppWare Bus provides a way of connecting components similar to that of OLE. So what is the rationale for creating yet another object linking scheme? The two systems are actually quite different. OLE is a document-centric technology where many applications work co-operatively on the same compound documents. AppWare Bus, on the other hand, is intended to connect software components directly that can be as small as a function. To allow interaction between the two 'worlds', Novell is featuring an OLE ALM in the first release of Visual AppBuilder.

The next version of the AppWare Bus will be distributed, allowing applications developed to run on one machine to be transparently Client/Server aware. One benefit gained by this approach to Client/Server is the low traffic generated on the network since the communication goes through the AppWare Bus which can detect, for example, similar events.

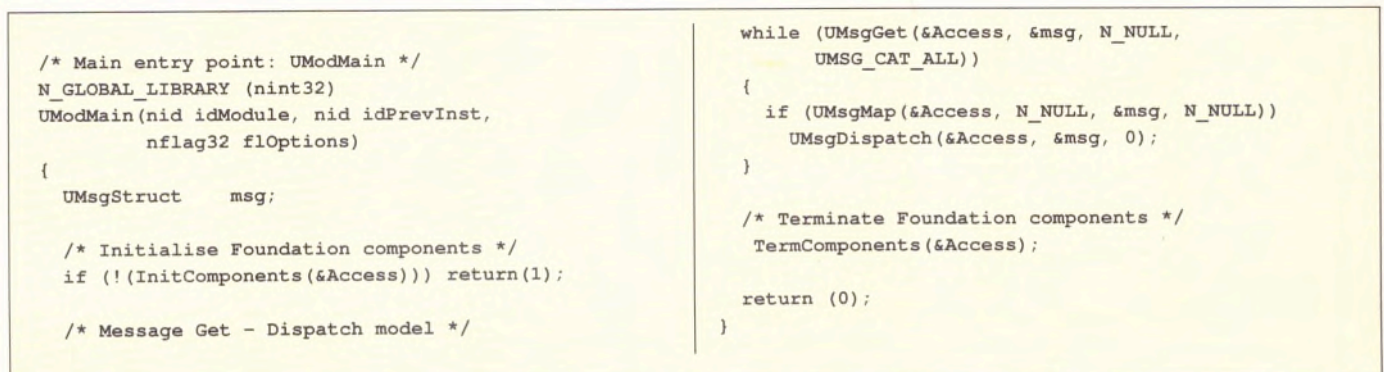
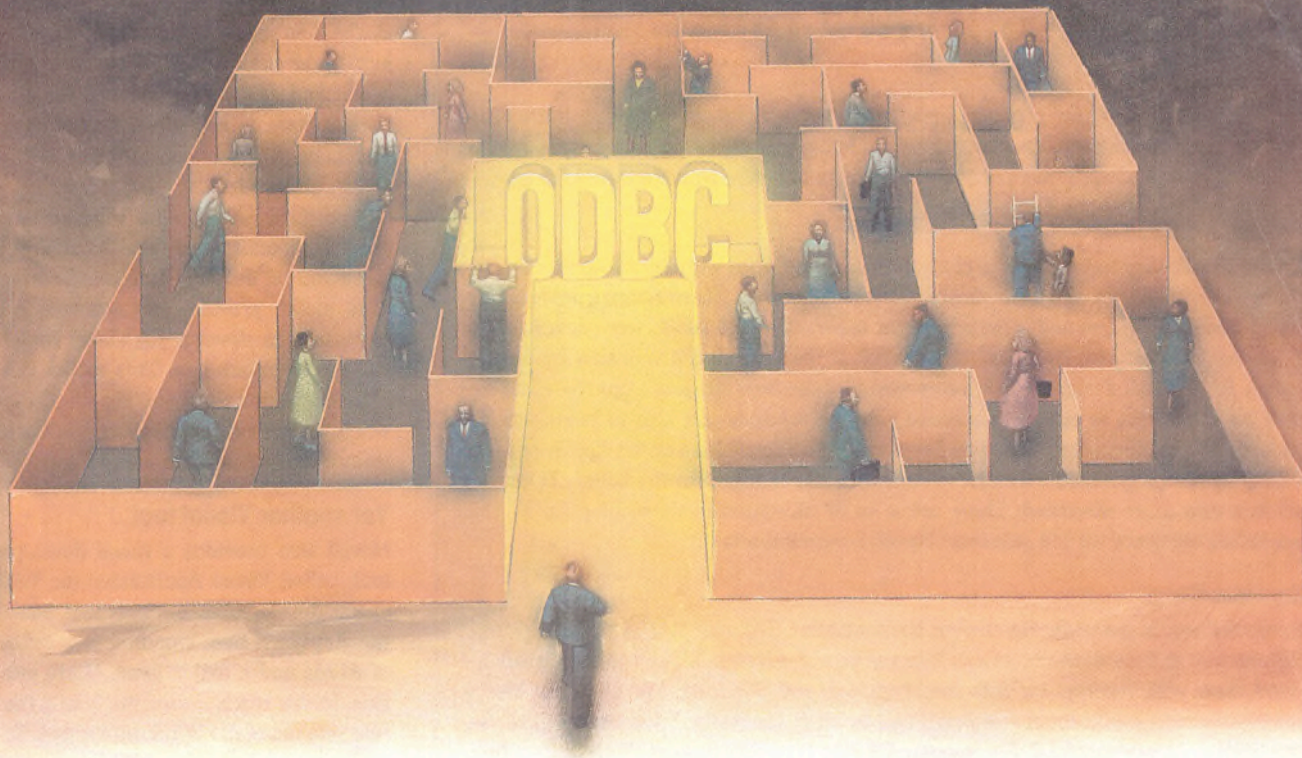


Figure 4 - Example of a main procedure



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AppWare talk

Although not all AppWare products have been released in their final form, there is already a user community. Developers using AppWare are either beta-testers of the products or were already users of one of the products before Novell entered the game:

Brookhill Software

Brookhill Software has a portfolio of applications developed with Visual AppBuilder including several ALMs with more than 2 MB of executables. These range from accounting to payroll programs and include a ledger application. The ALMs were developed in C for the PC platform. Brookhill chose VAB at the time that it was sold by Serius, mainly for the GUI designing. It's now waiting for the final releases from Novell, to extend its application to take into account network services and also to begin writing portable ALMs. According to Reggie Rogers, VP, the acquisition of the AppWare technology by Novell generated a major evolution: 'it has changed for the better. The product is a now more advanced. There are a lot of third-parties developing for it. The marketing exposure we will gain from Novell is very important.'

Cerebus Corp.

Cerebus Corp. is currently developing Internet Atlas (IA) with VAB. IA puts a graphical interface in front of the American Internet provider Netcom. The application will be stand alone with versions for both the Macintosh and Windows. The choice of Visual AppBuilder was made about two years ago by Matt Quajliana, President of Cerebus, then independent consultant. He compared it with the other tools available at that time and went for it. The principal rationale for the choice was that the company was looking for a tool which would allow high level development. The main competitor to VAB was HyperCard which suffered from the fact that almost all the specialisation was through XCMDs, each extension being completely independent and unaware of other extensions. Matt Quajliana is enthusiastic: 'the architecture in VAB is the best I have seen; ALMs provide a completely flexible environment. VAB is as powerful and as robust as an environment can be. Our company is moving out of the consulting side to the commercial software side. We are convinced that AppWare is a good technology, we now want to prove that it is good for commercial development.' Most of the Internet Atlas application has been developed within VAB using the standard ALMs. Only 25 KB have been written in C for a few specific text processing functions. Matt Quajliana is impressed with VAB's development over the last two years: 'there were not as many ALMs as are available today. Performance has also improved.' He sees good prospects for VAB in the future: 'performance is good and it's getting better. All the issues that were pointed out in the beta testing have been fixed.'

The AppWare product family

To access this technology, Novell and other companies such as Attachmate, Sybase and Borland provide tools and ALMs for AppWare developers. Each tool is aimed at a particular type of developer covering a spectrum of needs: from the high level application designer requiring a visual tool to the 3GL developer. However, not *all* tools

are available on *all* platforms. The priorities at present are surprise, surprise Windows and Macintosh, then the different Unix 'flavours'. NT, Chicago and OS/2 versions are apparently coming soon.

The AppWare Foundation is the tool for 3GL developers, it is supported on several OS and network environments. The Foundation is composed of libraries and an API respecting the C calling conventions. A C++

class interface to the Foundation is currently in final beta. It has been developed by Borland in collaboration with Novell. ObjectWindows for AppWare (or OW/AW), as it is called, is a C++ framework including a 'model-view-controller' mechanism. OW/AF maintains a close compatibility with ObjectWindows 2.0.

For third parties who want to develop tools compatible with the AppWare Bus, there will be the AppWare Bus Toolmaker. This toolkit provides the software engine necessary to develop high-level tools that use the AppWare bus. This toolkit is available only directly from Novell. In other words do not expect to see an AppWare tool from Microsoft anytime in the future.

Yet another Visual tool...

Novell also provides a visual development tool, called Visual AppBuilder (or VAB): a visual development environment based on the AppWare Bus, comprising a collection of ALMs and a tool to plug ALMs into the Bus. In this article, I used the beta 3, the current release, of the Windows version. To create an application within VAB, all you have to do is select object and function icons with the mouse, enter the parameters, then link ALMs together. It's as simple as that!

The screen presents two windows: a main window in which to edit your application and an object and function palette at the bottom. The first thing to do is create a new project - this is how an application is called. Then you must create at least one *subject* which is a *sub-project*. A subject can be viewed as a module: a way to structure a large application. In the subject you place the icons of the objects needed, which can be grouped together. By double clicking on an object, its parameters, if there are any, can be set. By the same principle, functions must be dragged in the subject window. The next step is to create links between objects and functions. This is done visually by drawing a line from an object to a function and assigning a label corresponding to the triggering event. If an object must trigger several functions for different events, several lines can be drawn; each with a different label. If several functions must be linked, you just have to draw a line between them.

The object visibility is limited to the sub-

```
/* Getting a bmp from the clipboard */
nint idBitmap;
nint32 lSize;
if (UClipOpen(pAccess, N_NULL, N_NULL,
UCLIP_OPEN_READ))
{
```

```
lSize = UClipGetData(pAccess, N_NULL,
UCLIP_TYPE_BITMAP, &idBitmap, N_NULL);
UClipClose(pAccess, N_NULL);
}
```

```
/*Return the native id for a pipe object */
UPipeGetNative(pAccess, idPipe, &idNative);
```

Figure 5 - Examples of the API in the Network Connectivity Series

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ject into which the object is contained. To use an object from a different subject, all you need to do is alias objects from one subject to the other. The aliases are resolved by the AppWare Bus compiler. Once developed the application can be executed in the debugger or compiled in an independent executable that can be given away with the appropriate DLLs. The debugger is limited to stopping the execution at break points and then inspecting some of the objects.

The ALMs present are for the most part high-level software objects. The essential ALMs include everything needed to build an interface, to control the flow of the program and the interactions with devices. In addition are included in the beta, a database, a client-server, a multimedia, an OLE ALM from Novell and some from third parties. Some of the ALMs included need some native software in order to work, so they are not really free at all. But hey, it sounds nice when you read it at first: they're really included to give you a taste of what is possible (the Extra! ALM from Attachmate, the ClearAccess and ClearManager ALMs from ClearAccess all fall into this category). The ImPower ALM is sufficient by itself and includes viewer and scanner support (it includes a teaser screen on the configuration for the other ALMs developed by ImPower). The set of ALMs from Novell is fairly comprehensive and helpful for most developments, but the other ALMs included do not yet show a strong involvement from third parties.

The first general release of VAB has been delayed from the announced date of June to somewhere at the end of the Summer. It will apparently be included in the

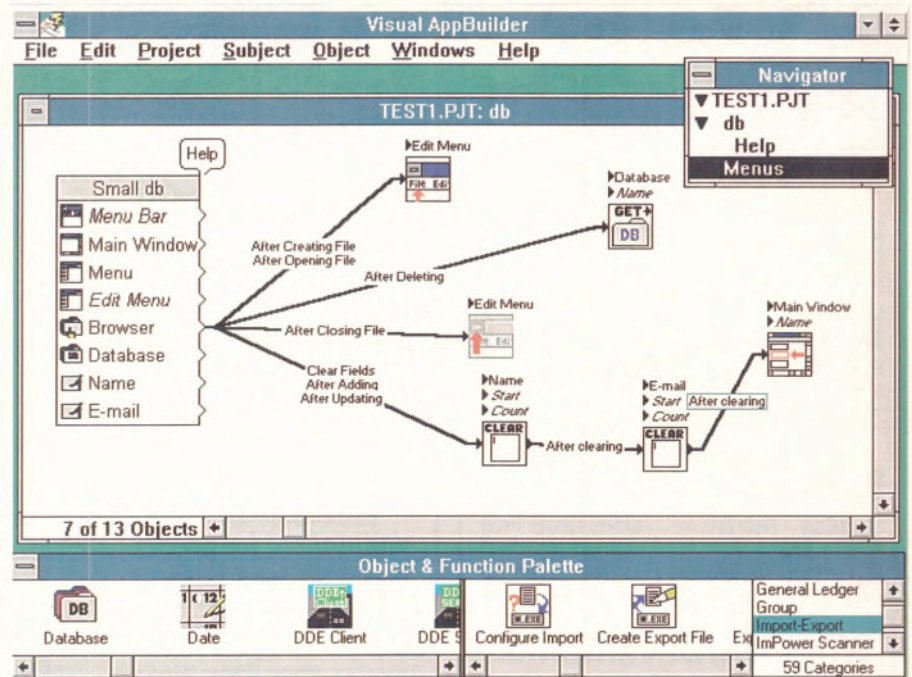


Figure 6 Main subject of a small database application

WordPerfect PerfectOffice 3.0 suite that will ship this Autumn. Version 1 of VAB will be delivered for Windows and the Macintosh platforms. Unix versions should come soon after. The second release of the product will include an important feature: a distributed AppWare Bus. The evolution towards a distributed bus means that applications developed today using shared objects on the same machine will become client-server when the next version of VAB is released.

Strategy to seduce competitors?

There is already a need for an application that fulfils AppWare's aims. Hopefully

Novell will have already taken this into account at architecture level. The success of AppWare will therefore depend mainly upon the availability of tools and ALMs for all popular development platforms. On a global scale, AppWare is reminiscent of Bedrock ('is it still in development or has the project been completely killed?'). This similarity, however, lies only in the specifications, not in the marketing of the technology!

AppWare is an important architecture for Novell in that it is used internally (for example the next version of WordPerfect Symmetry is being developed with AppWare and the two high-end versions of the new WordPerfect suite will include VAB). If we look at specific parts of AppWare, then there are already many proficient competitors (in the database access for example). Some current competitors however, could become partners by developing ALMs based on their respective products. This road has been taken by Powersoft or Wall Data, it remains to be seen who else will develop their wares for AppWare...

VAB and AppWare Foundation will be available respectively at about £300.00 and £400.00 per seat per platform from Novell UK. Phone: 0344 724000, Fax: 0344 724001.

EXE is organising an AppWare seminar, FREE to all EXE subscribers who wish to attend, with Novell on Wed 7th September at Novell's Bracknell headquarters. For details on how to enroll see the advert in this issue.

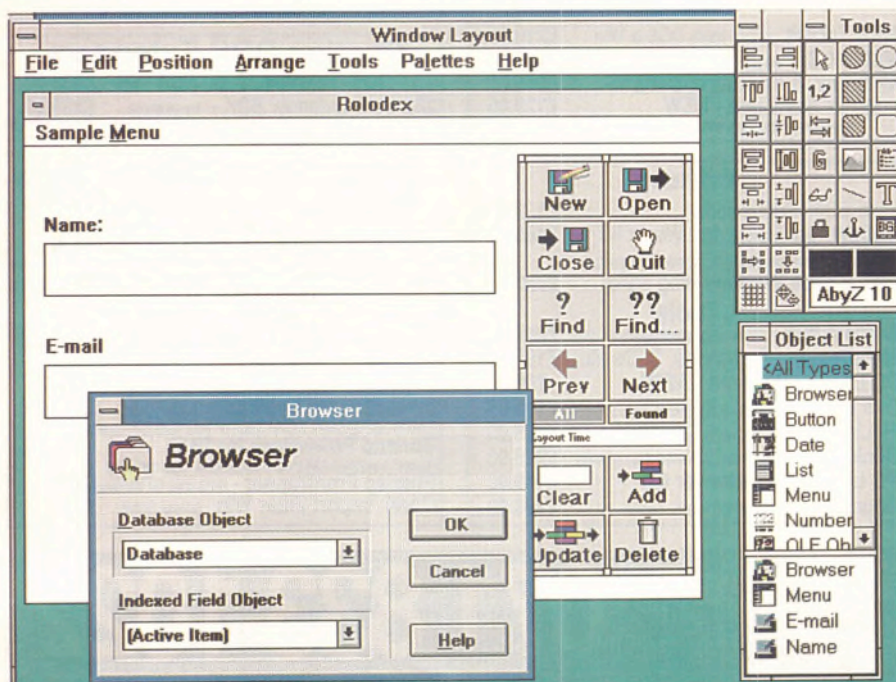


Figure 7 - Design of the interface

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Embedding in the 90s

If you look hard enough at the things we take for granted, computers, in one form or another are ever-present. **Cliff Saran** reports on what's driving them.



Click. It's 6.30 and the clock radio awakes with a chirpy melody and an even chirpier DJ. Drive to the station. Stop at lights. Pull in at the 'hole in the wall'. Reach for the ticket at the carpark barrier, up the escalators, head for the ticket machine. Glance at the train schedule. Next train's due in 15 minutes. Quick call to the office to warn of certain lateness. Finally board train and eventually get to work having been subjected to the workings of hundreds of hidden computers throughout the journey.

These are not the beige coloured boxes that await at the office. They are not designed to respond to the general needs of a user. Instead they are used to accomplish specific tasks. The timer in the clock radio, the engine management system of the car, the phasing of the traffic lights, the ticket machines at the carpark and station, the train schedule display all belong to a family of computers known as embedded systems. These are the computers that fit seamlessly into our lifestyles such that, in many cases, we don't even know they are there.

There's no limit

By their very nature embedded systems are everywhere. The diversity of application areas is phenomenal. The tools, techniques, hardware and software which must be applied to create a washing machine programme of fast colours, woollies, spin dry, whites, are quite different from those which deliver fuel to the booster rockets of the space shuttle Columbus. Both, however, are classified as embedded systems.

In the past, embedded systems were linked intricately to simple 4- and 8-bit microprocessors known as micro controllers, such as the 8051. With demand for more complicated systems arose the necessity to use more powerful processors. The 68000 family is undoubtedly the most popular and can be found in anything from a laser printer to a telephone exchange. As the price of 32-bit and RISC processors fall, they have become increasingly popular in embedded systems that require the highest level of performance.

With the simpler 8- and 16-bit processors

The problem facing many developers building embedded systems is the immense cost of the development system itself.

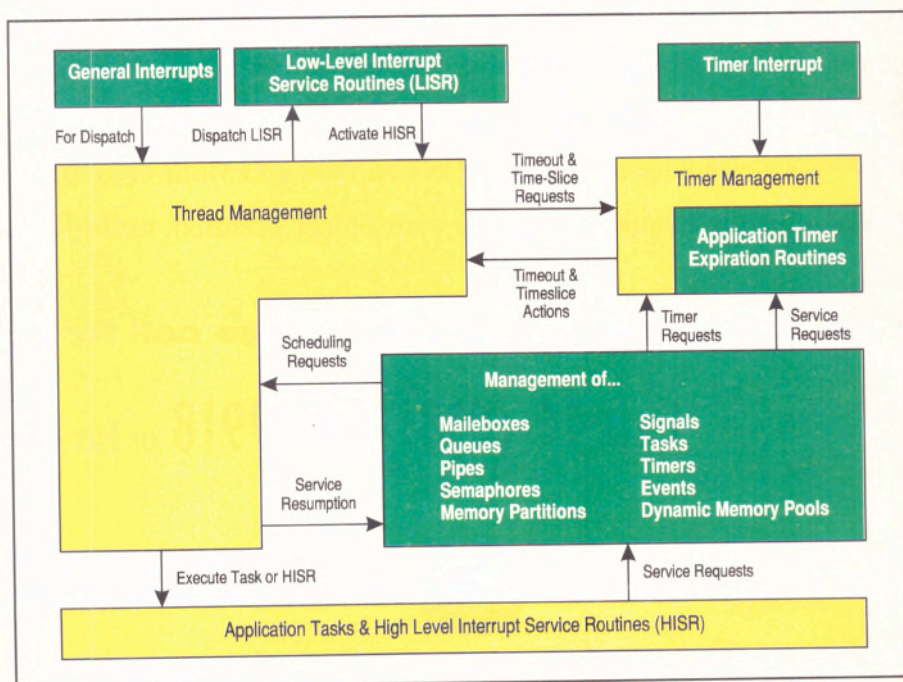


Figure 1 - Structure of the Nucleus+ RTOS



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it is common for engineers to sculpture the entire software for the embedded system they are building themselves. Here, the software developers are required to produce not only the actual application, but also the operating system kernel that links the software to the underlying hardware. Such practices are acceptable when building relatively straightforward systems or when it is necessary to maintain an existing code base. They are extremely inefficient and unsuited for delivering to market rapidly embedded systems which use high performance 32-bit processors. In the embedded systems tools market there are innumerable companies which specialise in building real time operating systems (RTOSs) that provide instant kernel software.

A recent trend is that of the embedded PC, a PC on a chip or a card the size of a cigarette box. There are several advantages with building such systems, not least the relative low cost of the PC card itself. The BIOS can support PC features like keyboard, video and comms ports. On the software side there is the ability to boot into DOS and, as a consequence, be able to run DOS software.

Get real

An obvious requirement of a RTOS is that it be rommable. In many situations it is inappropriate to have cumbersome disk drives or run serial or networking cables in order to download the operating system software into memory. This puts an upper limit to the amount of memory, or footprint it can occupy. The smaller the better. The smaller it is, the less space it consumes in valuable ROM memory: leaving more space for the embedded application software itself.

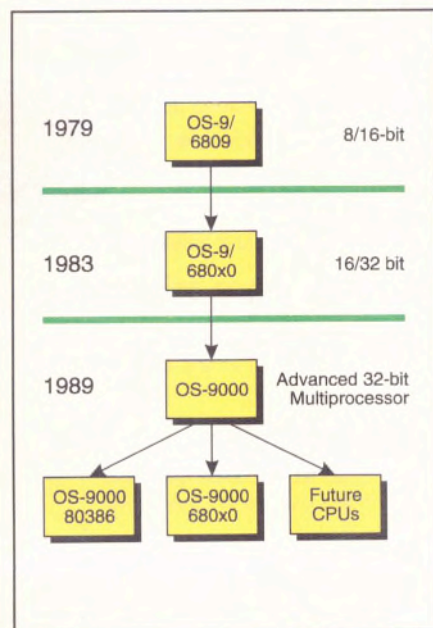


Figure 3 - Evolution of OS-9 and OS-9000

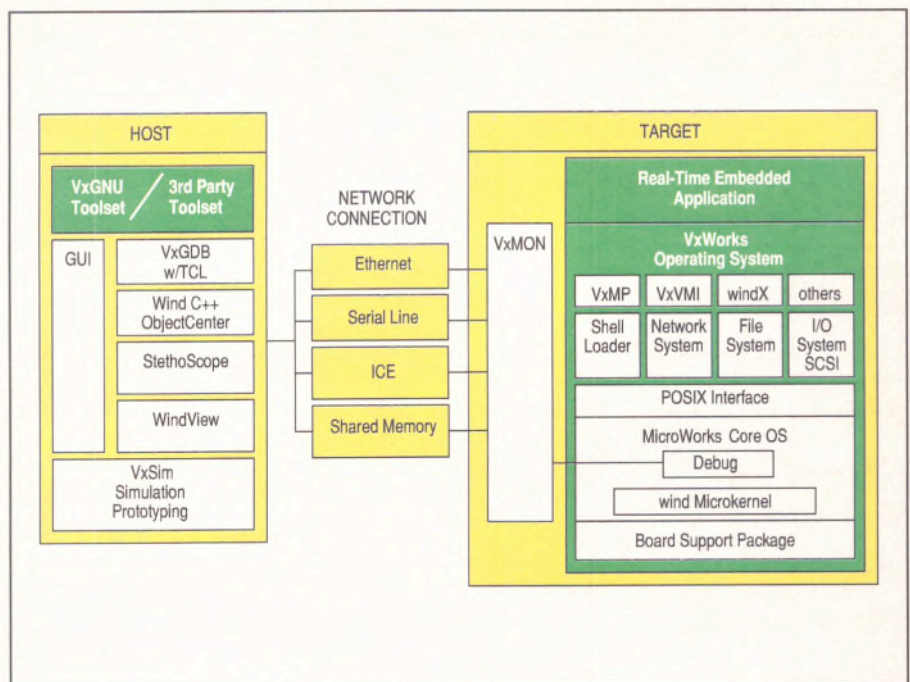


Figure 2 - Target/Host relationship in VxWorks

The interface to the outside world is through external events which present themselves as interrupts to the system. The time taken for these interrupts to be serviced, known as interrupt latency, is critical. In a nuclear reactor, when the instrument panels light up with warnings of overheating, one doesn't wait for a meltdown but takes corrective measures immediately.

Unless the application is very simple there will be a need to run more than one task at a time. Task scheduling ranges from a simple round-robin approach to complex prioritised preemptive scheduling. Once there is more than one task to be completed, a mechanism for inter-task communication will be necessary. Queues are used to send multiple messages from one task to another; mailboxes are for when there is just one message and pipes provide a byte stream between the tasks. With interrupts flying about everywhere and several tasks running at the same time it is essential to provide semaphores to protect critical sections of code and data structures.

Due to the time-critical nature of embedded systems software, there are often two types of memory management available. Dynamic memory allocation, while being very flexible, suffers from the fact that it is not possible to determine exactly how long the system will take to allocate a block of memory. The duration depends on the number of free blocks remaining on the heap and whether a defragmentation process must be run to free up large memory blocks. Consequently dynamic memory allocation is unsuitable when a given task must be completed within a predetermined

time. For such a task memory partitioning is more appropriate. Here, memory is divided into a predefined number of fixed sized blocks. There is no defragmentation so the application programmer can guarantee that memory will be allocated within a given time.

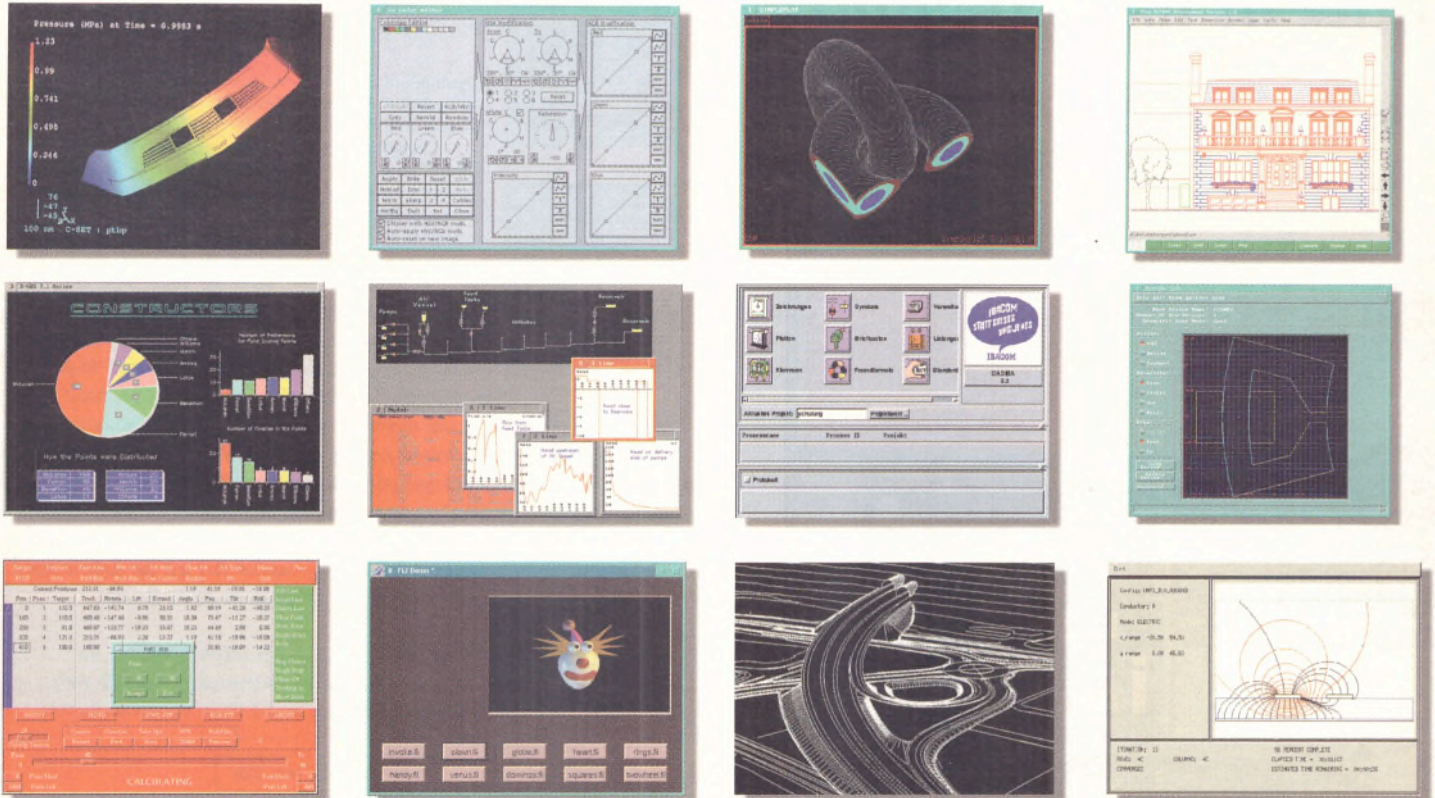
One final requirement, and perhaps the most basic of all, is that the RTOS must support the hardware of the embedded system. If it uses an obscure processor or an unusual chipset then it is highly unlikely that a suitable RTOS would be found, in which case the application developers will have to write one for themselves. Now that we know what to expect let's take a closer look at some real RTOSs.

Nucleus Plus

Accelerated Technologies, based in Alabama, was established in 1990. Its first product was a real time executive called Nucleus RTX for the AMD 29000 RISC processor. Nucleus Plus is the company's second. It is available on a diverse range of processors including the 68HC16 micro controller, CISC x86 and 68K product families and a number of RISC processors including 29000, 80960, MIPS, SPARC and ARM60.

The architecture takes a microkernel approach allowing users to create new services by combining existing system calls. The kernel is implemented as a C library which means that the systems software only includes portions of the Nucleus Plus RTX that the application actually uses. Accelerated Technologies sees the most significant feature of the kernel as its ability to perform preemptive multi-tasking with prioritised

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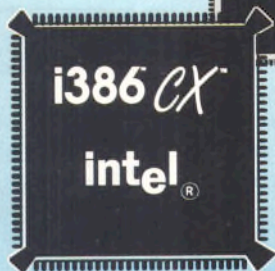
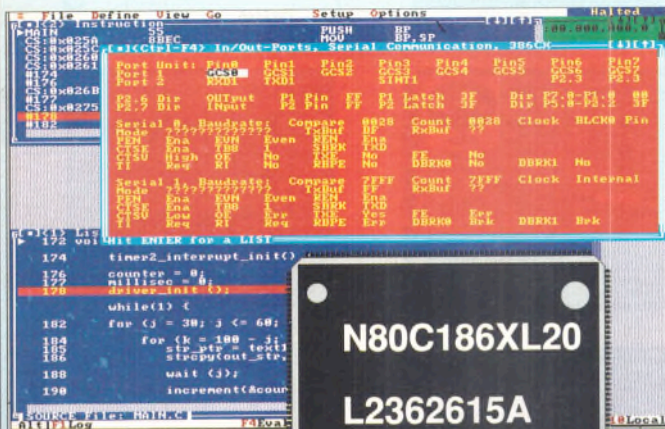
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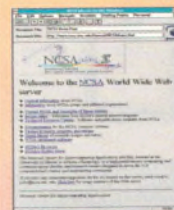
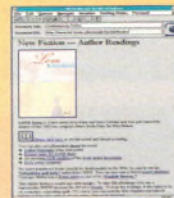
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scheduling of user tasks. In real time speak, the kernel is deterministic with low interrupt latencies. Inter-task communication is achieved through mailboxes, queues and pipes. Both fixed-length and malloc-like memory management are supported.

Nucleus Plus is written in ANSI C which should ease porting to new processors in the future. It is distributed royalty-free with source code included in the price. C compilers supported include Borland C++ for x86 Real Mode; MetaWare High C and Watcom C for x86 Protected Mode; Microtec Research C Compiler for 80960, 68K and SPARC and BSO Tasking C Compiler for MIPS. Prices start at \$5,400 for the 68K and x86 Real Mode processor families. A Protected Mode BIOS version (PC) is priced at £7,100. Remote debugging is available through the Nucleus DBUG+ product (£1,295) a command line interface which enables developers to interrogate the Nucleus Plus environment including tasks, queues and events. Additionally, Accelerated Technologies offers an interface to the Microtec Research XRAY debugger for source level debugging in a windowed environment. This option is priced at \$1,595.

Accelerated Technologies

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VxWorks

Wind River Systems has been going since 1983. It is headquartered in Alameda, California and went public in 1993. The company offers a range of tools for embedded systems development including VxWorks

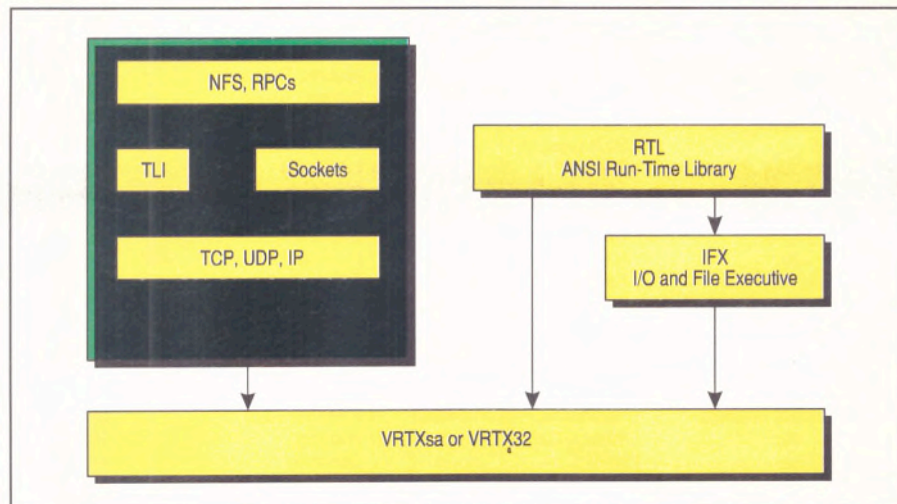


Figure 4 - Configuration options of VRTX

and MicroWorks RTOSs and development environments. Both of these are based on the Wind microkernel. The difference between them lies in their respective target markets. While VxWorks is aimed at development of complex, hugely specialised embedded systems, MicroWorks targets the low cost, high volume market. Both products are available on a wide range of host and target platforms. CISC processor targets include 68K, CPU32 family including the new 356 embedded DSP and 386/486. On the Risc side there's SPARC, i960, 29000, MIPS R3000 and DEC Alpha. Wind River Systems is in the process of porting to PowerPC and MIPS R4000. The most popular host system is Sun. Other hosts include popular Unix platforms and the PC running Windows.

The Wind microkernel offers multi-task-

ing with both preemptive and round robin scheduling. Context switching is deterministic. There are four mechanisms by which tasks can communicate. These are message queues, POSIX pipes, sockets and shared memory. Memory management is of the dynamic variety.

The feature that distinguishes Wind from its competitors is the ability to plug in subsystems on top of the kernel. The networking subsystem provides complete Unix-standard networking via Ethernet, backplane, serial line and custom network interfaces through system hooks. It offers TCP/IP with support for sockets, remote logins, remote procedure calls, Network File System (NFS) and FTP clients and servers. SCSI and POSIX I/O is available as well MS-DOS and RT-11 file systems

Combined with the Wind microkernel is a complete development environment which includes cross compilers and remote source level debuggers for the host system. On the target system there's a performance monitoring facility, an interactive C-interpret shell and linking loader as well as a library of over 600 routines. Additional components that can be bolted onto VxWorks include a client package for Motif, a virtual memory interface and a multi-processing package. VxWorks is licenced per project which means that the cost doesn't increase per user.

For the development system a typical Sun host for 68K costs £16,600. A royalty must also be paid which ranges from around £430 for 10 units shipped to £13 when there are 5,000 or more.

Wind River Systems

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OS-9

Microware started out 17 years ago with a version of OS/9 for the 6809. This RTOS is perhaps the most well known of all. Proces-

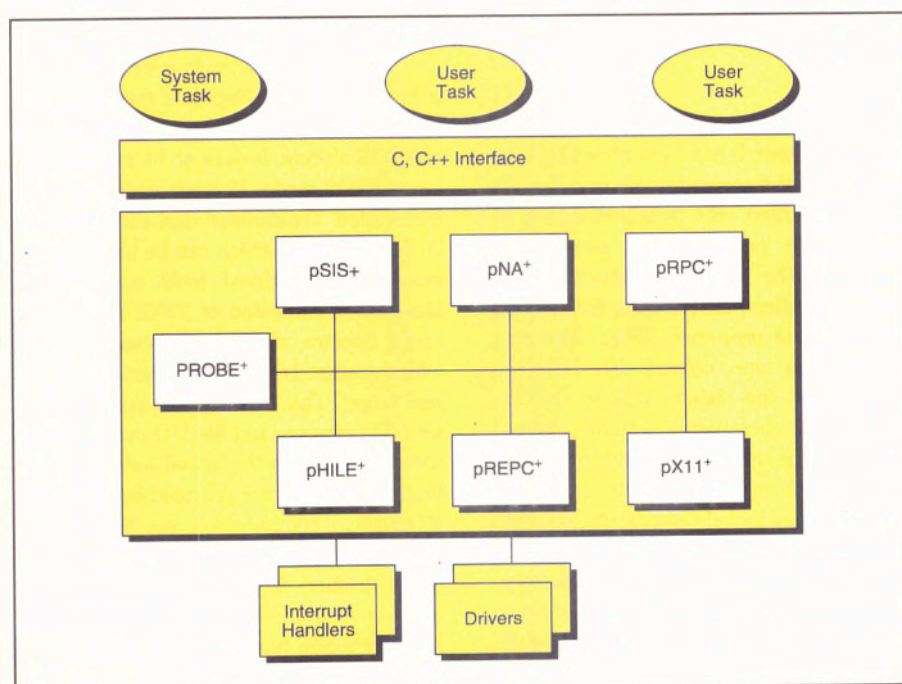


Figure 5 - The pOSystem environment

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sor support today is restricted to the 68K family which includes the CPU32 processors. OS-9 is written in assembler. About five years ago the company decided to develop a portable version, aimed at the PC 386/486 and 68K marketplace, which later became OS-9000. Today, Microware is currently porting OS-9000 to the PowerPC. Given the close relationship between the two operating systems, it is likely that the next release of OS-9000 will be known as OS-9.

The kernel is based upon a modular architecture which provides configurability. Multi-tasking is of the Unix variety using Unix-style processes and I/O models. The task scheduler is priority-based and preemptive. As expected, OS-9 provides several familiar mechanisms for communicating between tasks and synchronisation. These include semaphores, pipes, signals, events, shared memory and alarms.

The Professional Edition of OS-9 provides a complete development environment for 68K systems. It includes an ANSI C compiler with Plum Hall validation and a source-level debugger that offers conditional breakpoints, watchpoints and frame tracebacks. There is also a Unix-like shareable Standard library which can be used both by OS-9 and OS-9000, PVCS version control, microEmacs editor and system and boot debuggers. The compiler itself is able to generate code that is ROMable, reentrant and position-independent. The kernel includes modules for file management which can support serial, parallel, disk and tape

I/O.

Professional OS-9 for a PC host costs £1000 to £1,700 depending on configuration. However OS-9 is sold largely as a self-hosted target system for VMEbus, MultiBus and other popular architectures. For ROM-based embedded systems there is Industrial OS-9 which reduces the overhead needed for the comprehensive I/O support of the Professional version. Licensing depends on the number of units shipped. With numbers in the order of 1000, the cost is £29 per unit. With 5000 that sum is reduced to £12.

Microware
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VRTX

Microtec Research has been providing tools for embedded systems for two decades. Recently it merged with Ready Systems, increasing the products and services for customers. The family of products include C/C++ compilers, assemblers, linkers and, of course, the renowned XRAY debugger. Two RTOSs are offered by Microtec. VRTX32 is the latest release of the VRTX/OS operating system kernel; VRTXsa is an upward compatible, scalable kernel based on VRTX. Target processors available today include 68k family, 386/486, 29000 and SPARC. Microtec, in line with other leading providers of embedded systems tools has stated it is developing a port of VRTX for the PowerPC. Unix and PC hosts are available.

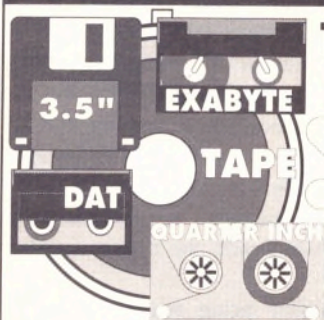
As expected, VRTX provides preemptive,

priority-based task scheduling. Inter-task communications and task synchronisation facilities including message queues, counting semaphores, mail boxes and global event flags. Dynamic memory is allocated from fixed sized pools

VRTXsa is a new architecture based on a technology which Microtec calls the nano-kernel. This provides a way to support multiple cooperating APIs on the same processor, allowing for greater code reuse. The kernel is a superset of VRTX and adds support for message broadcasting and priority-inheritance mutexes. On the memory allocation front it supports dynamic heaps.

The development environment for VRTX is Spectra, which offers post crash analysis that allows the developer to display the state of RTOS objects. It does so by switching to a non-RTOS mode. There is an 'open' interface called ToolBuilder that contains over 70 function calls which can be used to integrate with additional tools and utilities. Host-based emulation of VRTX is available under Spectra, allowing applications to run with the same I/O and OS interfaces as the real target. That means exceptions, character I/O, streams and file I/O can be tested without access to the actual hardware. Debugging facilities are provided by XRAY and RTsource, configuration via Xconfig and Motif-based performance analysis through Xpert Profiler. A typical development system would comprise the Spectra environment for a Sun host targeting VRTX32 on a 68K. The cost of such a set up is in the order of \$10,000 per seat. Run time royalty on

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> CIRCLE NO. 620

FEATURE

the kernel is based on numbers of units shipped and the type of application. As a rough guide, for 100 units the cost would average out at £90; for a 1000 it would go down to £30.

Microtec Research
0256 57551

PSOSystem

Integrated Systems manufactures a RTOS based on the pSOS+ microkernel which is available on a number of RISC and CISC processors. The list includes the entire 68K family, 68300, 88000, 386/486, i960 and now the PowerPC. Host platforms supported are IBM, SPARC and HP Unix boxes.

The microkernel is of the preemptive multi-tasking variety. So it can perform services on demand; schedule, manage and allocate resources and coordinate asynchronous activities. Round robin task scheduling is also available. Facilities for inter-task communication include variable length queues, events and asynchronous signals. For memory management, both fixed length and dynamic allocation are available.

The pSOS kernel is at the heart of a modular architecture known as pSOSsystem. It can be extended with multi-processor support, TCP/IP networking and a

remote procedure call library. Integrated Systems additionally provides a high speed file system called pHILE+ which can be used in conjunction with the networking and remote procedure call modules to build client NFS services. An ANSI C standard

By their very nature embedded systems are everywhere.

runtime library and the X Windows System are also available.

pSOSystem offers a host development system for Unix and DOS which includes optimising C/C++ compilers, simulator for the target CPU, an operating system simulator and a source and system-level debugger. There is also support for XRAY and pPROBE+, a back-end for XRAY which resides on the target system.

Integrated Systems
0223 420999

Adding up the costs

I hope this small selection of kernels discussed gives a taste of what's out there in real time world. The five covered are high

end kernels devised to be embedded in systems for the mass consumer market or for highly specialised and extremely expensive application areas such as inside flight simulators. In the former, the unit cost of the actual product becomes a limiting factor. Hence the runtime royalty is extremely low such that it adds little overall cost to the final product. In the latter, the immense cost of the product dwarfs the royalty for the kernel.

The problem facing many developers building embedded systems is the immense cost of the development system itself. While there is no doubt that the software (and hardware, emulators for example) is extremely complex, can a small outfit of, say, five developers, justify a bill in the order of £15K for the development tools it will require?

While the practice of writing RTOSs in-house is diminishing, suppliers must encourage developers to buy off-the-shelf, even if it means cutting the prices of the development tools.

The box on page 28 is a specially compiled selection of suppliers who offer real time development tools and operating systems.



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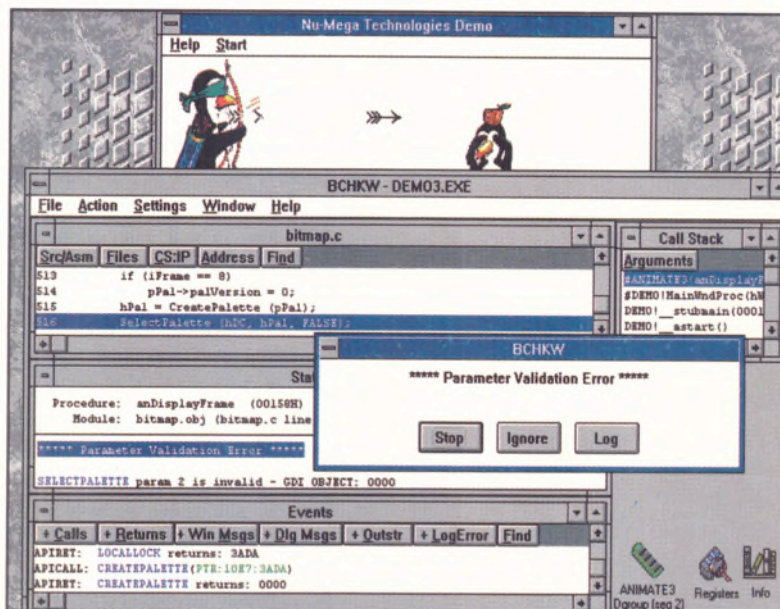
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Talking native ftp

You may use ftp every day to transfer files, but  do you know how it works? Laine reckons he does...

What really happens when you tell your FTP (File Transfer Protocol) client to transfer a file? As with any other publicly condoned TCP/IP protocol, the place to search for the answer to that question is in the 'RFCs' (Request For Comments), a series of documents available online (by ftp, of course) which records almost all the developments of TCP/IP from the inception of the Internet Engineering Task Force (IETF) in the early 1970's to the present. In the case of FTP, there are several RFCs dealing with the protocol, but the most current that I found in my search of the RFC index was RFC 959 - 'File Transfer Protocol (FTP)' available by anonymous ftp from `src.doc.ic.ac.uk` in `/computing/internet/rfc959.txt` or on disk from EXE. RFC 959 is especially useful because it replaces all previous RFCs concerning FTP. RFC 959 was first distributed in 1985 and is still valid today. I guess that qualifies FTP as a 'stable' protocol.

Today the most visible use of ftp is in the client programs we use to transfer files manually back and forth, but the original intent of the protocol designers had a more general purpose. They envisioned that ftp would be used by all TCP/IP-aware software wanting to transfer files and directory listings, automated as well as manual. The effect of this vision shows up in the protocol, as we'll see in a minute. So, even though you only need RFC 959 to have a full specification of FTP, you may want to skim through the older RFCs so you'll understand why some things turned out as they did. All other FTP related RFCs are listed in RFC 959.

Client/server, but twisted

As with all TCP/IP protocols, FTP is based on a Client/Server model. It's a bit twisted around though. Whereas the other protocols we have discussed on these pages (Telnet - EXE Aug 1993, SMTP and POP3 - EXE Feb 1994) use a single TCP connection to send both data and commands, FTP uses a pair of TCP connections, one for control information, and one for data. Usually, TCP port 21 is used for the control connection, and TCP port 20 is used for data. (TCP, remember, provides a reliable byte stream between two processes on (possibly) different machines). Command and status messages

are sent on the control port, following the Telnet protocol (in terms of character set, turning echo on/off, newlines, etc). The data port usually sends and receives pure binary data, although it can be placed into different modes for special applications.

The FTP server is always listening on port 21 for a client to open a control socket. Once a socket is opened, the client first

USER <SP> <username> <CR-LF>
PASS <SP> <password> <CR-LF>
ACCT <SP> <account-information> <CR-LF>
CWD <SP> <pathname> <CR-LF>
CDUP <CR-LF>
SMNT <SP> <pathname> <CR-LF>
QUIT <CR-LF>
REIN <CR-LF>
PORT <SP> <host-port> <CR-LF>
PASV <CR-LF>
TYPE <SP> <type-code> <CR-LF>
STRU <SP> <structure-code> <CR-LF>
MODE <SP> <mode-code> <CR-LF>
RETR <SP> <pathname> <CR-LF>
STOR <SP> <pathname> <CR-LF>
STOU <CR-LF>
APPE <SP> <pathname> <CR-LF>
ALLO <SP> <decimal-integer> [<SP> R <SP> <decimal-integer>] <CR-LF>
REST <SP> <marker> <CR-LF>
RNFR <SP> <pathname> <CR-LF>
RNTO <SP> <pathname> <CR-LF>
ABOR <CR-LF>
DELE <SP> <pathname> <CR-LF>
RMD <SP> <pathname> <CR-LF>
MKD <SP> <pathname> <CR-LF>
PWD <CR-LF>
LIST [<SP> <pathname>] <CR-LF>
NLST [<SP> <pathname>] <CR-LF>
SITE <SP> <string> <CR-LF>
SYST <CR-LF>
STAT [<SP> <pathname>] <CR-LF>
HELP [<SP> <string>] <CR-LF>
NOOP <CR-LF>

Figure 1 - List of FTP commands (from RFC 959)

The FTP client spends its time translating the commands you type into commands recognised by the FTP server

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Code	Meaning
200	Command okay.
500	Syntax error, command unrecognized. This may include errors such as command line too long.
501	Syntax error in parameters or arguments.
202	Command not implemented, superfluous at this site.
502	Command not implemented.
503	Bad sequence of commands.
211	System status, or system help reply.
212	Directory status.
213	File status.
214	Help message.
215	NAME system type. Where NAME is an official system name from the list in the Assigned Numbers document.
220	Service ready for new user.
221	Service closing control connection. Logged out if appropriate.
421	Service not available, closing control connection. This may be a reply to any command if the service knows it must shut down.
125	Data connection already open; transfer starting.
225	Data connection open; no transfer in progress.
425	Can't open data connection.
226	Closing data connection. Requested file action successful (for example, file transfer or file abort).
426	Connection closed; transfer aborted.
227	Entering Passive Mode (h1,h2,h3,h4,p1,p2).
230	User logged in, proceed.
530	Not logged in.
331	User name okay, need password.
332	Need account for login.
532	Need account for storing files.
150	File status okay; about to open data connection.
250	Requested file action okay, completed.
257	'PATHNAME' created.
350	Requested file action pending further information.
450	Requested file action not taken. File unavailable (eg., file busy).
550	Requested action not taken. File unavailable (eg., file not found, no access).
452	Requested action not taken. Insufficient storage space in system.

Figure 2 - Some Specific Result Codes for FTP

identifies and authenticates itself via the control socket (with the **USER** and **PASS** commands), switches to the appropriate directory (**CWD**) and sets appropriate transfer modes (**ASCII**, **binary**, etc with the **TYPE** command). It then sends a **PORT** command telling the server which IP address and TCP port (usually 20) to use when opening its data connections. Finally, the client starts a socket listening on port 20 and issues either a **STORE (STOR)** or **RETRIEVE (RETR)** command to put or get a file to/from the server. In response to, say, a **RETR** command, the server sends a status message on the control socket saying 'I'm sending!' It then opens a data socket to the IP and port given in the **PORT** command (20), sends the data on the socket, closes the data socket, and sends another status message on the control socket saying 'I'm done!'.

When all transfers are complete, the client sends a **QUIT** to the server and the control socket is closed.

This may seem overly complicated just to send a file. Other protocols figure out ways of marking the end of the data to allow using one socket for both control and data, such as a '.' by itself on a line in SMTP. There is some method to FTP's madness, however. As well as removing any restrictions on the data being sent across the line, keeping the data and control separate opens the door to 'way cool' applications that run on computer A and transfer files from computer B to computer C. As soon as we've learned enough FTP commands, I'll show you how this can be accomplished.

FTP commands are always sent from the client to the server. A list of the commands is shown in Figure 1. Those familiar with

FTP will notice that these commands don't necessarily correspond to the 'CD', 'GET', 'PUT', etc you are accustomed to using at the keyboard. The FTP client spends its time translating the commands you type, into commands recognised by the FTP server. If you're lucky enough to have a client such as WS_FTP (a glitzy public domain ftp for WinSock - see below for availability) you'll be treated with a debug log of all the commands sent to the server for each of your requests.

Status Results

Since commands only go from client to server, results only go in the opposite direction. As with other TCP/IP protocols, most results are sent in two flavours simultaneously - a three digit numeric result at the beginning of the line (intended for a program to interpret), followed by descriptive text (intended for a human) and a CR-LF. While the second and third digits provide more detail about the message, the first is the most important. A simple-minded state machine can decide what action to take next based solely on this first digit. In Figure 2 I have listed most of the result codes specified in the RFC.

Sometimes it is desirable to have multiple lines in the descriptive text of a message. For example, to tell about the contents of a directory when the user changes to it, or to give a list of alternate ftp sites if the login fails because of overly high load. If this is the case, the three digit code on the first line will be immediately followed by a '.' instead of a space. The last line will have the same three digit code followed by a space. A client that is only looking for the codes must still account for the possibility of multi-line messages

Note that if a line in the body begins with a number, the server will always pad it with a space at the beginning, so you should be able simply to look for the next line starting with a three digit number followed by space.

Goodbye, don't cry...

I'll be back next month to discuss how we navigate the directory hierarchy, make connections and transfer data. I'll also have a running program that demonstrates it all.

Laine Stump is a software engineer at Morning Star Technologies in Columbus, Ohio. He can be reached via email as laine@morningstar.com. Any example code mentioned in Laine's articles can be downloaded via anonymous ftp from <ftp.morningstar.com> in /pub/cpp.

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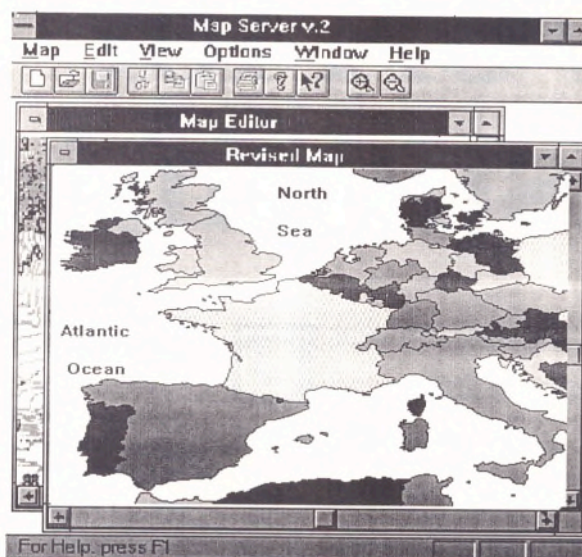
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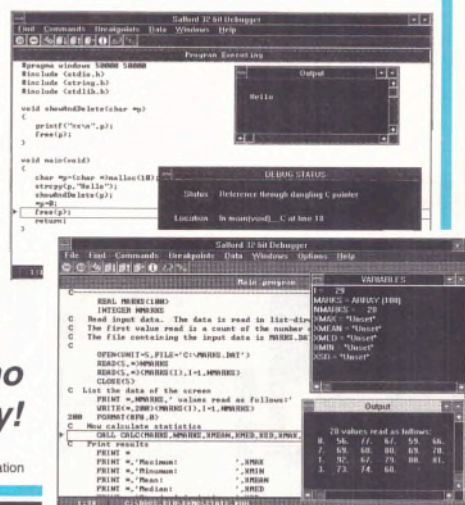
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OCX for the aspiring alchemist

Earlier this year  Microsoft announced OCX (or OLE Custom Control) as the official replacement for the hugely successful Visual Basic Custom Control. Using Bits Per Second's experience with its own graphing OCX, **John Marsh** illustrates in detail the practicalities of creating an OCX

As everyone must surely now be aware, Visual Basic has been a colossal success, especially in the corporate development environment. In the course of the last three years it has transformed the way in which Windows applications are developed. I suspect it has been largely responsible for the final demise of DOS, certainly as a vehicle for application development.

What VB has really done, though, is create a new world of component-based software development in which objects (controls, components... call them what you like) provide the bulk of the core functionality of applications, while the Basic language glues them together.

The key ingredient which has enabled this is the VBX (or Visual Basic Custom Control). Introduced almost as an afterthought in VB 1, the VBX has given component developers, such as ourselves, the opportunity to package innovative functionality into objects. These objects' behaviour can be controlled very simply through their properties and can interact with an application through their events. In turn this has enabled corporate solution providers to build applications for their users which previously would have been too unwieldy, too expensive or simply not technically possible. Component-based software development is now big business. It's growing daily.

The advantages it offers are numerous: more choice, better quality, better integration, easier custom solutions, reduced training and support and less redundant software on the desktop to name but a few.

The one fly in Bill Gates' ointment is that all this is currently based on the VBX - something which was never intended to be more than a means of extending Visual Basic. So why bother to replace something when it's been so successful? Well, there are a number of reasons, not least of which is that OCX, courtesy of it being based on standard OLE 2.0 technology, will be supported in many applications and development environments across all of Microsoft's 16- and 32-bit operating systems. Although Visual C++ was subsequently enhanced to support VBXs, the low-level interaction between a VBX and its container application is not that clean: the architecture of the framework required was not designed to port to 32-bits. Hence no VBXs for 32-bit Visual C++, nor for Access or FoxPro.

Some other software vendors *have* implemented support for VBXs, notably Borland, but Microsoft itself decided the correct thing to do was to get everyone back on track with the technology it had committed itself to as the object model for its future operating systems: OLE.

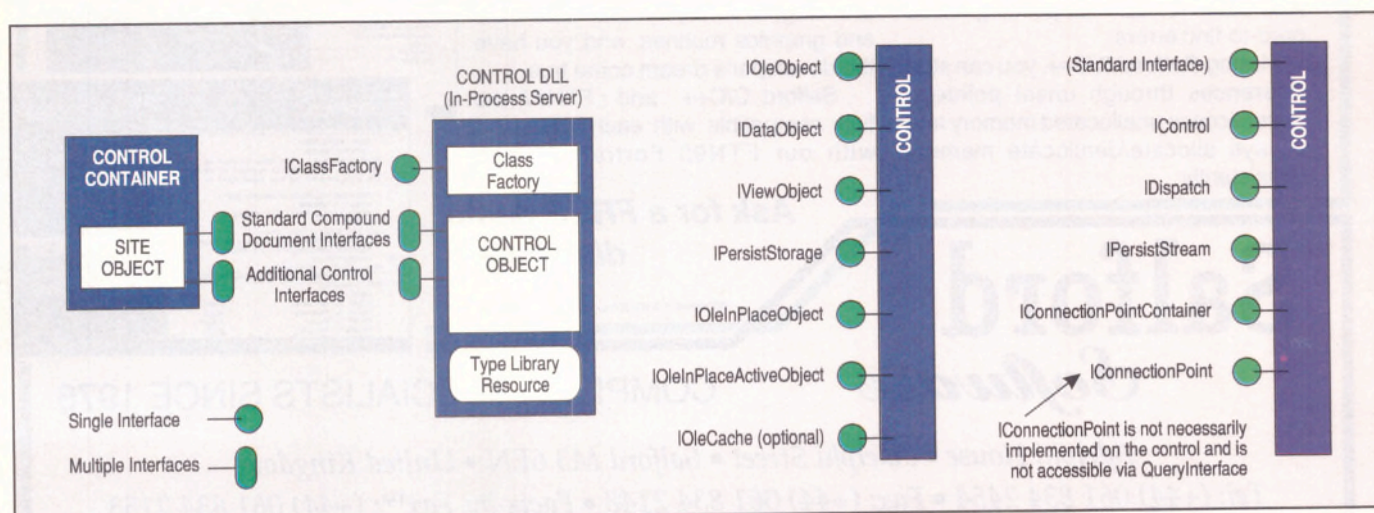
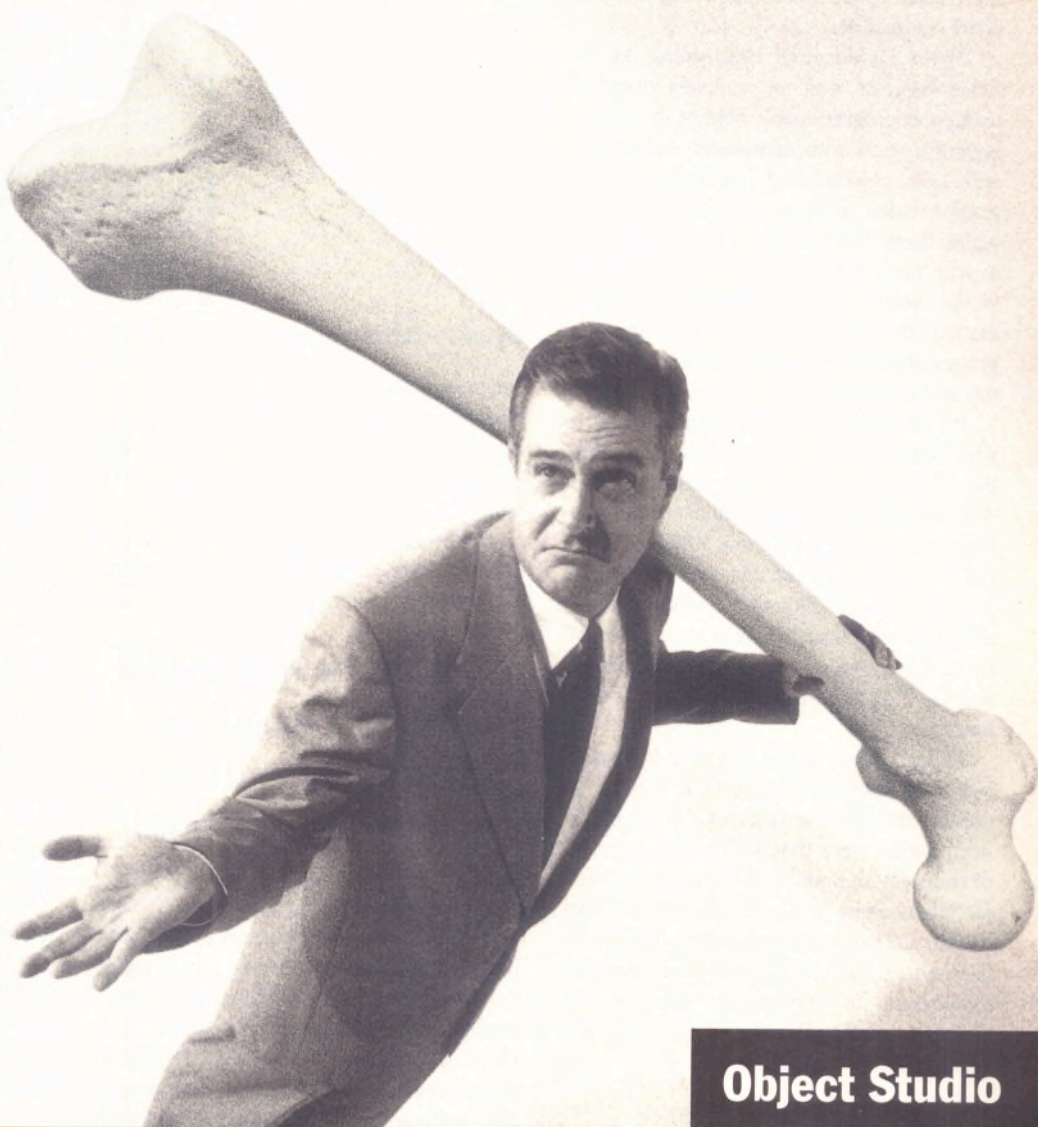


Figure 1 - OLE Control interfaces

Several million years ago, the dinosaurs were wiped out by a sudden climatic change. What they left behind, besides some impressive footprints, was a lesson for us all: adapt or die. This same parable applied to application development: if your applications are made extinct by changes in your business, you've got a problem. Fact is, because they can't effectively capture the essence of your business in the application, today's popular client/server tools—you know who they are—can't easily adapt. So when the business changes, you're back to square one. Not so with Object Studio™ from Easel Corporation. Object Studio is the first client/server development family that affords business

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The good news for developers is that, thanks to Visual C++, MFC and some new and very powerful wizards, an OCX is actually *easier to develop* than a VBX.

From VBX to OCX

Technically an OCX is what is known as an in-process OLE server. It is thus applicable to a much wider range of applications than just Visual Basic, and is inherently 16- and 32-bit compatible.

Object Linking and Embedding, as its name suggests, was not originally intended to support programmable objects. It was designed to deal with compound documents and how objects such as spreadsheets, graphs, video, sounds etc could be stored within them. But with the advent of OLE 2.0 a year ago, it became more oriented towards controls since it included OLE Automation, the word coined to describe the programmability of objects through properties and methods.

It's interesting to note, though, that even with Automation, OLE still couldn't match the VBX. Last year we developed an OLE Automation Server with almost the same functionality as our graphing VBX, but without events or persistence (the saving of property values). Although it worked okay, and gave us some valuable experience of OLE, there was no comparison between it and the VBX in terms of usefulness or performance.

In the course of the last year Microsoft has been busy extending OLE further to provide the missing features. I suspect it's been harder work than anticipated, because of course it not only had to match the VBX for functionality and performance, but also had to create some compelling reason to persuade us all to convert from the one technology to the other. Change for change's sake is all very well, but there is a limit!

Easier to develop than a VBX!

If you had to write an OLE server from scratch you would have a hard time - we know because we did... There are mountains of OLE documentation, most of it virtually unintelligible. Kraig Brockschmidt wrote a very good book about OLE called *Inside OLE 2* which tried to demystify it, but even he, in almost 1,000 pages, didn't get as far as OLE Automation, let alone all the new control-oriented functionality. He refers to OLE 2.0 as being equivalent to 'one third of an operating system' - certainly that's true in terms of the complexity of it all. There are a lot of really hard concepts to grasp.

To give you some idea of what I'm talking about look at Figure 1 which illustrates the three OLE 'interfaces' an OLE control

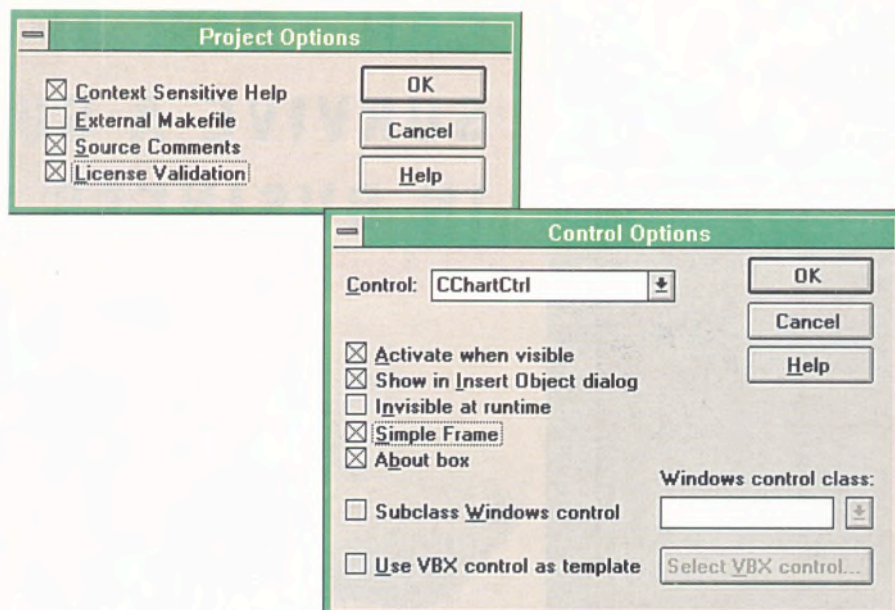


Figure 2 - Setting Project and control properties

has to support. Each interface has an associated set of functions which must be implemented in order for a control to function correctly. And this is before you start developing your own functionality.

But if you use the tools Microsoft has provided in the new OCX CDK, you can create a working OCX in 10 minutes without

If you had to write an OLE server from scratch you would have a hard time - we know because we did...

understanding anything at all about OLE itself. This is because the guys at Microsoft have created a Visual C++ class called `COleControl` (more of which later) which implements all the generic features of an OCX. It handles the entire OLE side of things, leaving you to define your properties, methods and events and to add your own functionality.

Off to see the wizard

Let's now look at the tools to build an OCX. The first thing you must do is install the Control Developers' Kit (CDK). For this to work you must have previously installed a copy of Visual C++ 1.5, since the CDK integrates into the Visual Work Bench (VWB) environment. After it has been set up, the most significant addition to the VWB is the ControlWizard, which gets added to the Tools menu.

To create a new OCX you select ControlWizard and choose your project and control options (see Figure 2). Project options allow the developer to set such things as context

sensitive Help, source comments and license validation. Options that can be set for the control itself allow the developer to specify whether it is activated when visible; displayed in the Insert Object dialog; invisible at runtime or bound by a simple frame. Other options tell ControlWizard that the control includes an About box or that it is data aware. Once you've chosen your options, ControlWizard creates the project for you by generating a number of files.

If you've already written a VBX and want to convert it to an OCX, there's a control option which will create a skeleton OCX from your VBX. It doesn't attempt to copy across any of your code, just the properties and events. For the sake of simplicity, I'm assuming here that you are creating an OCX from scratch.

Ready, register and run...

Next you select the **Make TypeLib** option from the **Tools** menu. This runs a utility to build your Type Library (.TLB) from the Object Definition Language file (.ODL) created by ControlWizard. The Type Library is the heart of an OLE object. It contains a description of the object and can be interrogated by a container application to find out its capabilities. In the case of an OCX the Type Library is the equivalent of a VBX's model structure and property/event lists. It lists the OCX's properties, their types and IDs, and also the OCX's methods and events (see Figure 5).

You then build the control just as you would any Visual C++ project by selecting the **Build** option in the **Project** menu. Note that you don't have to worry about setting the correct compiler or linker options: ControlWizard has done all this for you.

When the build has finished, you should

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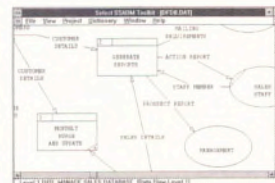
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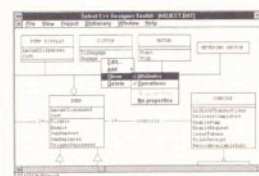
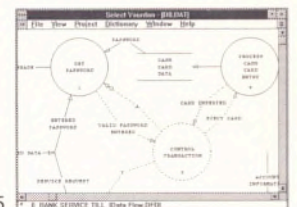
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```

// chart.odl : type library source for
// OLE Custom Control project.

// This file will be processed by the Make Type Library
// (mktypelib) tool to produce the type library
// (chart.tlb) that will become a resource in chart.dll.

#include <oledisp.h>
#include <oletype.h>

[ uuid(1B06E943-7704-101B-BC25-0080C82DA517),
  version(1.0),
  helpstring("Chart OLE Custom Control module") ]
library Chart
{
    importlib(STDOLE_TLB);
    importlib(STDTYPE_TLB);

    // Primary dispatch interface for CChartCtrl

    [ uuid(1B06E941-7704-101B-BC25-0080C82DA517),
      helpstring("Dispatch interface for Chart Control") ]
    dispinterface _DChart
    {
        properties:
            // NOTE - ClassWizard will maintain
            //       property information here.
            //       Use extreme caution when editing this
            //       section.
            //{AFX_ODL_PROP(CChartCtrl)
            [id(1)] short ChartType;
            //{AFX_ODL_PROP

        methods:
            // NOTE - ClassWizard will maintain method
            //       information here.

            // Use extreme caution when editing this section.
            //{AFX_ODL_METHOD(CChartCtrl)
            //{AFX_ODL_METHOD
            [id(DISPID_ABOUTBOX)] void AboutBox();
            };

    // Event dispatch interface for CChartCtrl

    [ uuid(1B06E942-7704-101B-BC25-0080C82DA517),
      helpstring("Event interface for Chart Control") ]
    dispinterface _DChartEvents
    {
        properties:
            // Event interface has no properties

        methods:
            // NOTE - ClassWizard will maintain event
            //       information here.
            //       Use extreme caution when
            //       editing this section.
            //{AFX_ODL_EVENT(CChartCtrl)
            [id(1)] void Hit();
            //{AFX_ODL_EVENT
            };

    // Class information for CChartCtrl

    [ uuid(1B06E940-7704-101B-BC25-0080C82DA517),
      licensed, helpstring("Chart Control") ]
    coclass Chart
    {
        [default] dispinterface _DChart;
        [default, source] dispinterface _DChartEvents;
    };
};

```

Figure 3 - Type library

register your control in the Windows Registration Database. This is because OCXs, like any other OLE server, must be registered before they can be used. Actually, courtesy of `COleControl`, OCXs are self-registering in that they have a standard entry-point which, when called, causes the OCX to be registered. Some containers, such as Access, will make this call the first time they use a control. In our case, by selecting the Register Control option in the Tools menu, we get the control to register itself in readiness for testing. Believe it or not, we're ready to start testing without having written a line of code!

Rigged for testing

A test container is included in the CDK because currently there are not many OCX container applications available. To run the test container you select it in the Tools menu, then ask it to insert an OLE control. At this point you will see a list of all the available OLE controls in the Registration Database, including the one you have recently built. Select it, then drop it on the container's form.

You'll see a box with an ellipse drawn in it. This is because ControlWizard has given your control some simple default behaviour, for example drawing an ellipse. Shortly you'll replace this with your own functional-

An oversight on Microsoft's part is the Registration Database which runs a serious risk of getting totally out of control.

ity, but this way you can make some immediate progress. Make a right mouse click on the border of your control and you'll see a small menu appear. Select the **Chart Control Object** (the OCX name we've chosen here) and then the **Properties** option of the drop-down menu that follows. You'll then see your first property page, which will be blank.

Property what?

Property pages are new to OCXs, VBXs didn't have them. They are the OCX's in-built user interface. If it wishes, a container application can provide an OCX with a user interface by interrogating the OCX's Type Library and displaying a VB-like property window listing all properties and allowing them to be changed. But as an alternative, the container can get the OCX to do this for itself by invoking its property pages. The container issues the new 'Properties' verb to the OCX. An OCX can have as many property pages as it wishes, each of which can control any number of properties. A property page is a form of dialog box which can be created using AppStudio. The idea is that they are all the same size and style, thus creating a uniform appearance. It's an open-ended enhancement to the original property window approach, but avoids the complete free-for-all of every OCX having its own proprietary user interface.

Each property page is in fact an OLE object in its own right, the link between property pages and the OCX's properties is implemented using OLE Automation. This

sounds complicated, but once again a wizard comes to our assistance as we'll see in a moment.

Ones own property

So far our control has no properties. To create one you open the RC file which fires up AppStudio automatically. Select ClassWizard in the Resource menu and you'll see two new pages - OLE Automation and OLE Events. Select **Add Property** in the OLE Automation page. You can then start creating your control's properties (see Figure 4). A property's external name is the one which the user will see ie the OLE Automation name.

You can now open the property page dialog and create an edit box. Select ClassWizard again, but this time choose the **Member Variables** page. **Add Variable** creates a member variable *and* links it to the OLE Automation name of one of the properties you've just created.

So what you've created is a property for your OCX and a means of getting/setting it via a property page. The reason you have to create a member variable for the property page and *then* link it to the OCX property is that, as mentioned above, the property page is a separate OLE object and has to communicate with the OCX via Automation.

Serving up events

The ability for the OLE control to generate events (and for the OLE container to handle events) is the key feature added to OLE to support controls. Events are added in ClassWizard. This time select **Add Event** in the **OLE Events** page and enter the name of your event, defining its parameters, if any. That's almost all there is to it. To complete the task, select **Add Function**

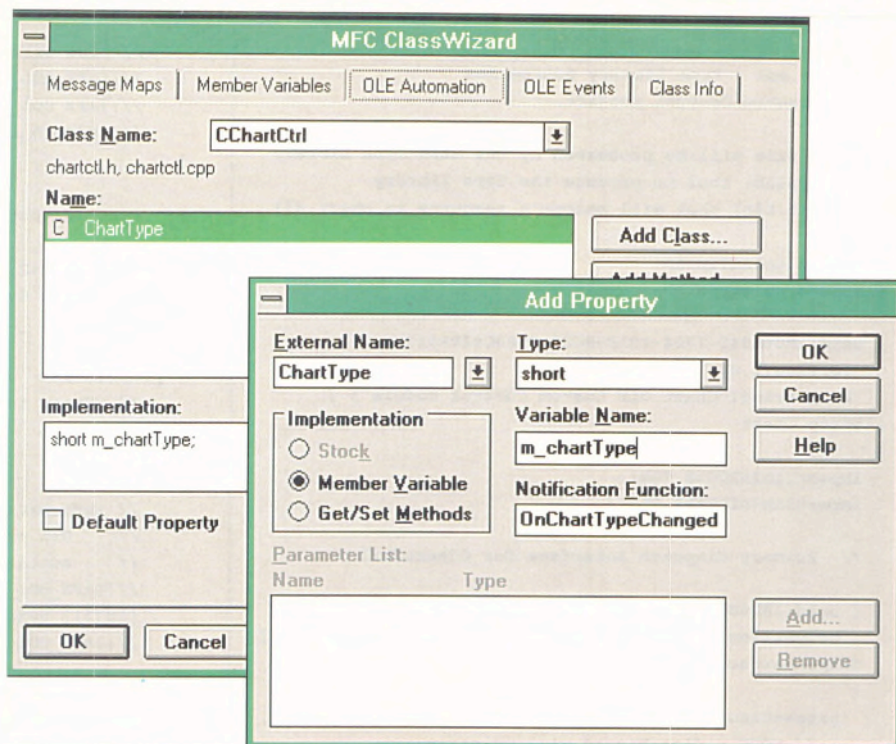


Figure 4 - Using ClassWizard to add features to an OCX

in the **Message Map** page and choose the Windows message which triggers your event. Finally use **Edit Code** to write the few lines necessary to identify and fire your event (if your event is triggered unconditionally from a windows message this will be one line of code).

Ellipses, but what else?

So now you've got a working OCX with a property or two and an event, but all it does is draw an ellipse. **COleControl** helps you once again by providing a member function called **OnDraw** which has a pointer to a device context as one of its parameters. It's here that **ControlWizard** has put in the two

GDI calls to draw an ellipse (see Figure 5). All you need to do is replace this with your own code and you've got a basic OCX up and running.

Help for help/data/licensing

These are three slightly more advanced topics, which are once again handled almost automatically for you. If you check the **Context Sensitive Help** option when you create your control, **ControlWizard** generates all the files you need to create a help file for your control. It even generates the batch file to run the help compiler.

Data binding (the ability for your control to attach itself to a data source) is achieved

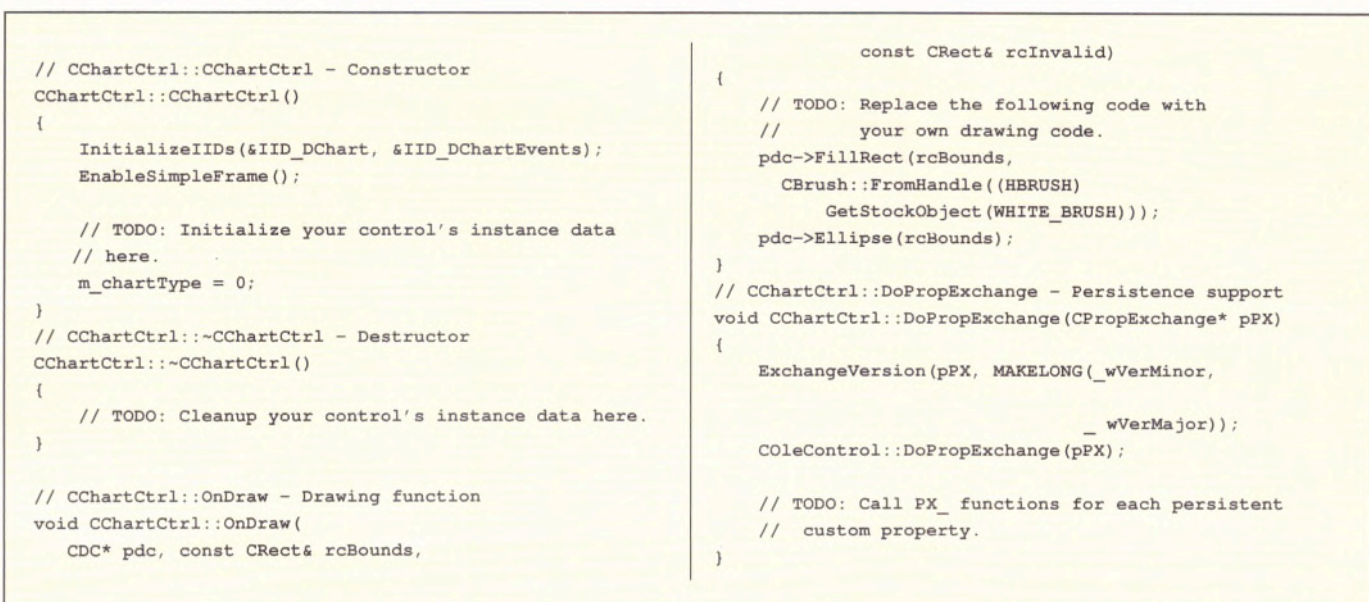
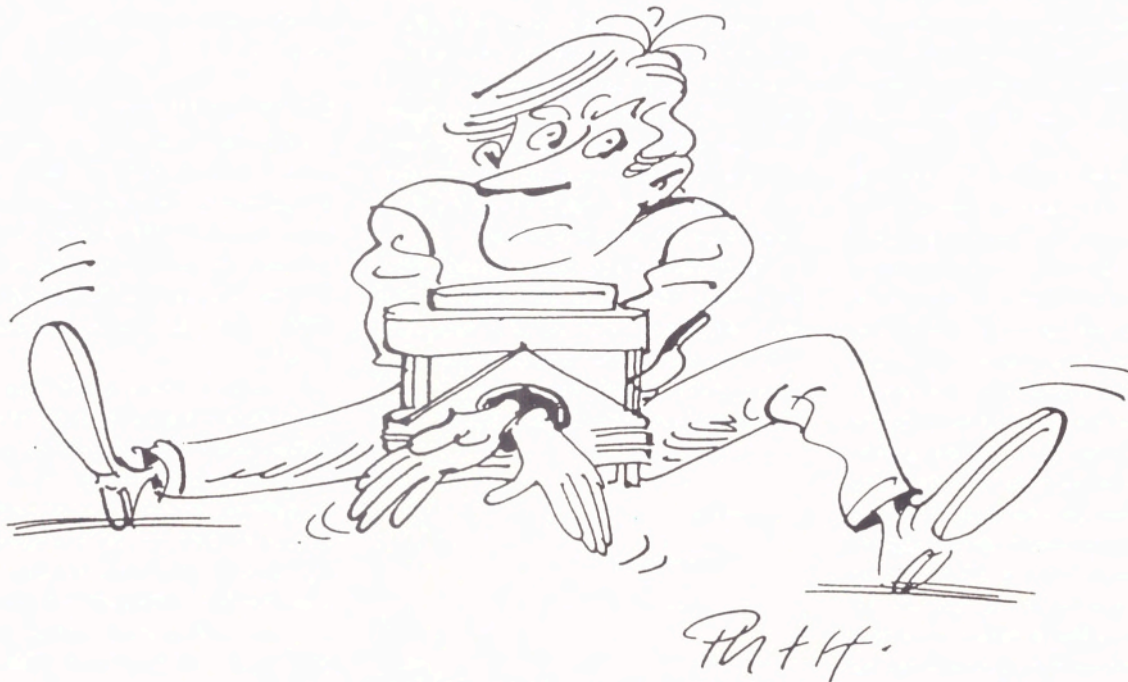


Figure 5 - The OnDraw member function

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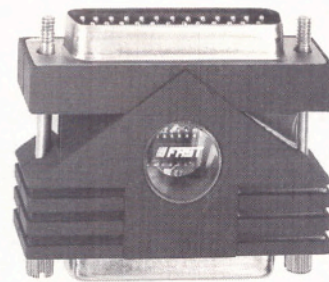
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OBJECTIVE

by checking the **Data Binding** option when you create your control and using ClassWizard to add a property with the **Bound Property** option checked. You've then got a property which can be bound to a field in a database. **COleControl** has a set of member functions you can use to request permission to change the property values, notify that the property values have changed etc.

Licensing is even simpler. By checking the **License Validation** option when you create your control, it acquires a full implementation of licensing - even a .LIC license file. What this means in practice is that your control will not run at design time unless its license file is present. When you sell your control to a developer, you state in your instructions that he is not permitted to distribute the license file. Thus any applications which he develops and distributes as EXE's will run fine, but your control can't be used by his users to develop further applications without purchasing a full copy from you. Simple but effective. In fact, the License Validation option provides more than this. It also implements a runtime licensing scheme which allows you to determine how your control is used at run time.

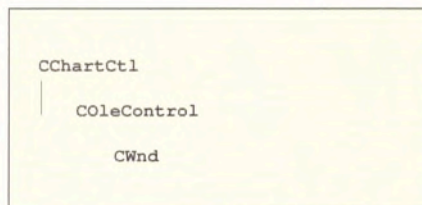
OLE down to Earth

COleControl is a large class. As we've seen, it protects us from all the details and complexities of OLE, so much so that you literally need know nothing about OLE. The only price you pay is in size - OCX's are not small. Even the rudimentary OCX we've created here is over 120 KB in size. However Microsoft is working on this, and an increasing amount of **COleControl**'s functionality is being implemented in a sup-

porting DLL (see Figure 6). By the time it goes final (it was still in beta at the time of writing this article) the size of an individual OCX may well have decreased further.

The chances are that you already have some functionality in the form of a LIB, a DLL, a VBX or C++ class library you want to package in OCX form. If you have a C++ class library you're in a very good position. In our case we had our graphing functionality available in all of these forms. We were able to take full advantage of our **CGraph** class library throughout our code.

The **COleControl** class is based on the MFC **CWnd** class as is our own **CGraph** class. When you build an OCX using the CDK you create a new class (in the example **CChartCtl**) based on **COleControl**. Thus your class hierarchy is as follows:



To produce our own graphing OCX we modified our **CGraph** class to derive from **COleControl** rather than **CWnd**, and modified **CGraphCtl** to derive from **CGraph**. Hence our class hierarchy was:

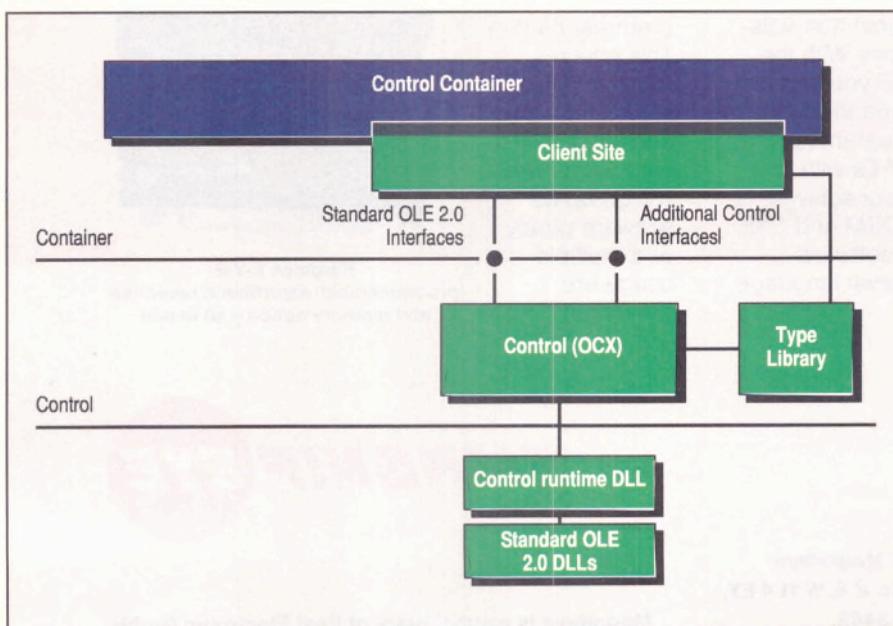
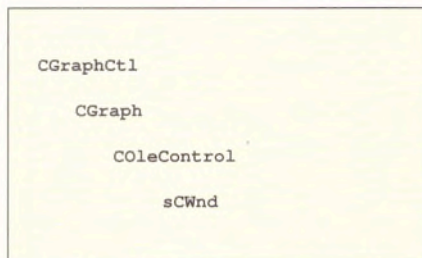


Figure 6 - OLE Control architecture

By doing this our OCX immediately acquired all the member variables of our **CGraph** class. By adding this to the framework already created by ControlWizard and ClassWizard, and the property pages we created using AppStudio we had a fully functional OCX.

E'ryone will be doing it

Looking back at the sheer amount of effort needed to build VBXs, at Bits Per Second we believe Microsoft has made an excellent job of the OCX CDK. And it's all thanks to C++ and the Foundation Classes. It makes me wonder what could have been done with VBX's had the same approach been adopted.

There is of course a down side. The purist developer is going to feel a little uncomfortable since he's not going to understand the underlying technology, or, if he insists on doing so, he won't be creating any OCX's for a good while yet. He'll be too busy wading through the documentation. An oversight on Microsoft's part is the Registration Database which runs a serious risk of getting totally out of control. With so many items being put in it, it won't be long before it's full of rubbish! Microsoft will surely have to come up with better management utilities so it can be regularly tidied up.

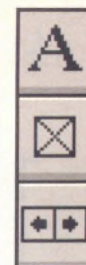
In the long term there is also a more gloomy prospect for the commercial OCX developer. The ease at which OCXs can be built will create more competition. Everyone is going to jump on the OCX bandwagon. As component-based software development becomes the norm, one must ask why there should be more than one spreadsheet; text-editing; graph component and so on, from which all future applications are built? With increasing standardisation of components, built using the same CDK, displaying same property pages etc, the distinction between competitive products will become less and less. This has already happened to a large extent in the application world. The scope for it to happen with components is even greater. But you can't stop progress, rather it's a question of being more imaginative and innovative. My message is: get busy right now and be the first to provide your functionality in OCX form!

John Marsh is founder and Chairman of Bits Per Second Ltd. For 10 years Bits Per Second has been helping developers enhance their applications in the most visual fashion, by providing them with a range of graphing libraries and tools for DOS, Windows and Windows NT. Bits Per Second is based in Brighton, England and can be contacted on 0273 727119.

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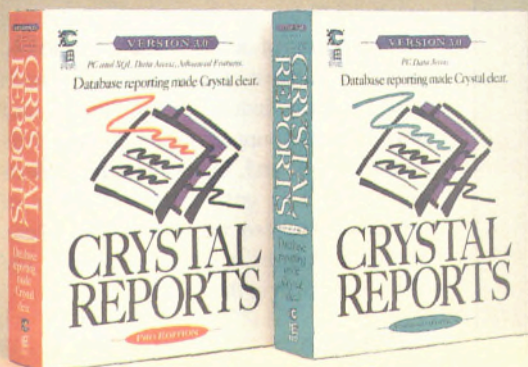
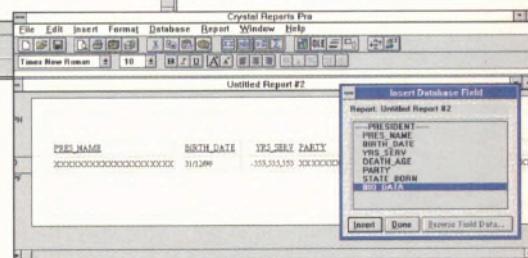
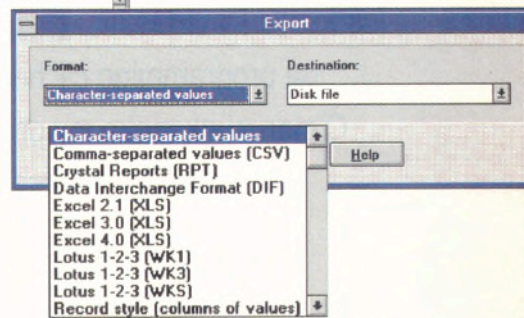
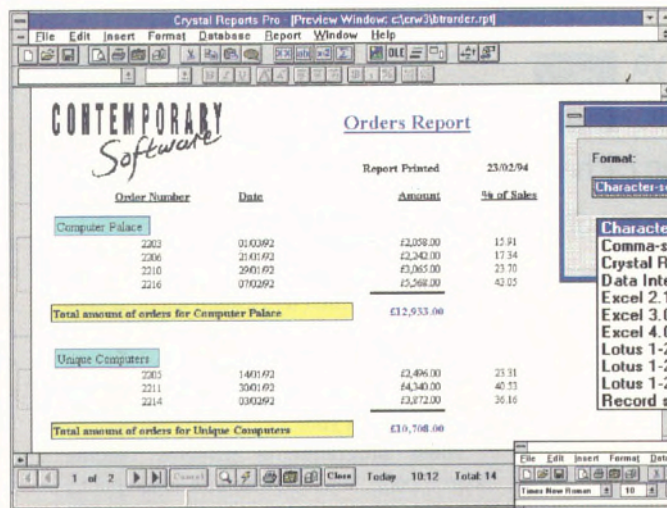
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Here's lookin' at ya
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on programming clichés.
C'mon punk make my day,
take my wife - *please*...

There's only one thing worse than fixing someone else's code, and that's fixing your own: you've only got yourself to blame. Six months ago, the hieroglyphics dancing before you on screen were a cunningly efficient way of implementing something or other. Of course, you'd never forget those little tricks that made it that bit faster, those assumptions which don't quite seem to hold anymore. But if you'd *known* you were going to have to add features six months down the line you'd have carefully commented the code. Wouldn't you?

Most programming involves reading source code. Whether the aim is to modify it, or just understand how it works, the task is error prone and time consuming. Let's face it, it's just downright irritating. Even comments don't always help: after all, they state the original programmer's intentions which is not necessarily the same thing as what the code actually does. The comments are also frequently out of date. How much better it would be if program comprehension was automated...

Some degree of automatic program comprehension is possible: the subject of program recognition is an active research area. This research is in part motivated by the need to maintain legacy systems, some of which were written years ago and contain millions of lines of code. Even small im-

provements in productivity can result in substantial savings.

In the beginning there was...

So how exactly is this being attempted? The aim of current prototypes is to speed program comprehension by abstracting the actual code and describing it in terms of 'programming clichés': concepts which concisely describe the code in terms understood by all programmers, sorting and searching being classic examples.

Clearly, it's not possible simply to compare the program text with a specific example of a cliché; there are just too many ways to express an abstraction. To handle this problem a number of interesting techniques have been developed, though there is only room here to discuss two of the more successful approaches.

But how can this be?

So how do we go about recognising program fragments? I tend to favour looking at the overall code and spotting key features which may suggest what the program is doing: this is where good layout becomes particularly helpful. I then test my understanding through more detailed analysis, either with a manual code walk-through, or with the use of a debugger.

The first part of this process bares some striking similarities to one automated approach, ie the search for program 'beacons' to provide evidence for the presence of particular abstractions. These beacons are relatively simple program fragments closely associated with particular clichés. For instance, the exchange of program variables might provide support for the existence of a sort routine. Normally, such beacons will not be sufficient in themselves to confirm the presence of a particular abstraction, though a number of beacons may provide strong support. Indeed a single beacon may provide partial support for a number of different clichés, and, like a detective collecting clues, it is only when a number of beacons associated with a particular cliché are found that the system can assume the cliché is present in the code.

PAT-a-cake

The Program Analysis Tool (PAT) is an example of such a system [1]. Programs are

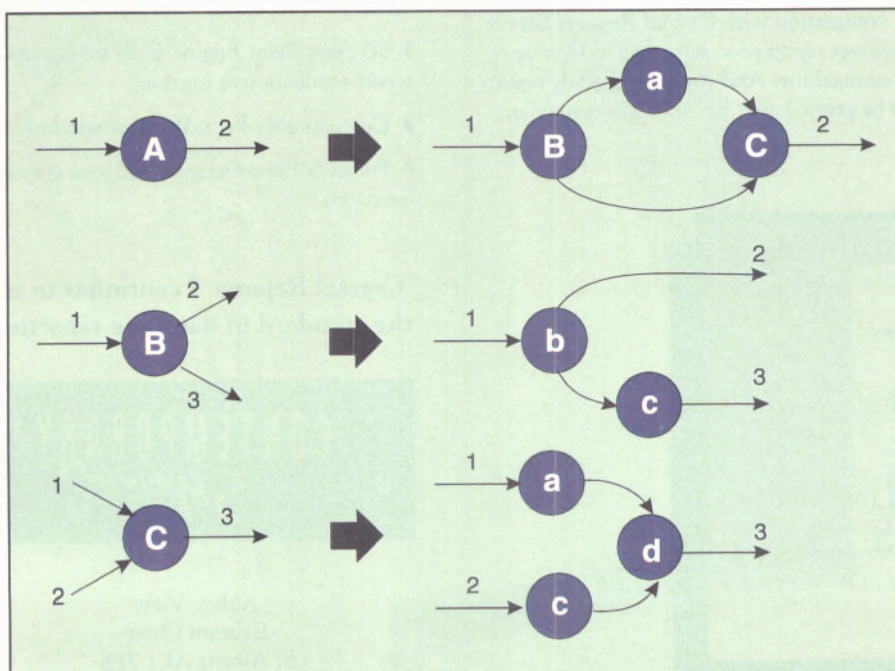
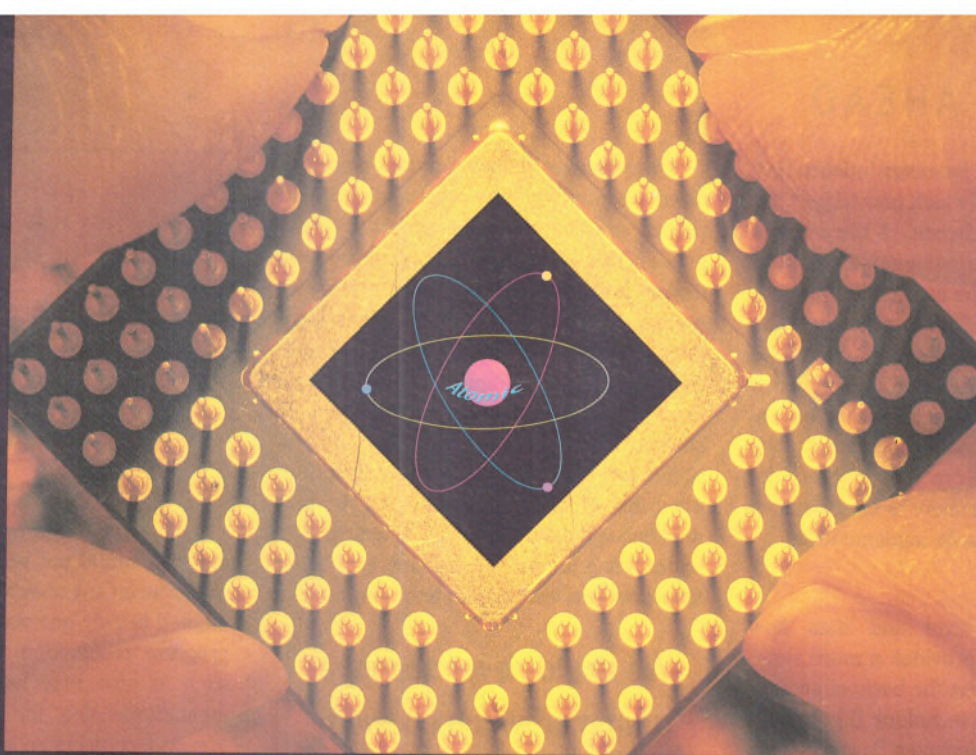


Figure 1 - A simple flow graph grammar



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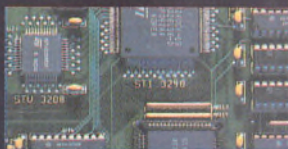
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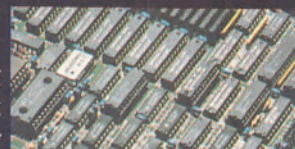
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rewritten as a set of language-independent beacons, a number of which may trigger the recognition of basic clichés. A hierarchy is then created, as the recognition of these may in turn trigger the recognition of more abstract clichés. PAT takes account of the beacons' order, where appropriate, and so an accumulation cliché is only identified if the initialisation of the accumulator occurs before any loop controlled increment. Unfortunately, beacons can only suggest the presence of a cliché; there is no guarantee that the program actually implements it.

Go with the flow

Examination of control and data flow through a program provides a more rigorous analysis and forms the basis of another program recognition technique [2]. In principle this approach derives a flow graph abstraction of the program which is similar to a flow chart. However, whilst flow charts emphasise the control flow through a program, flow graphs also detail the data flow with additional arcs. The change in program representation, from a textual form to a flow graph, gets rid of several sources of program variation, eg identifier names and some statement ordering details, where the statement ordering is arbitrary.

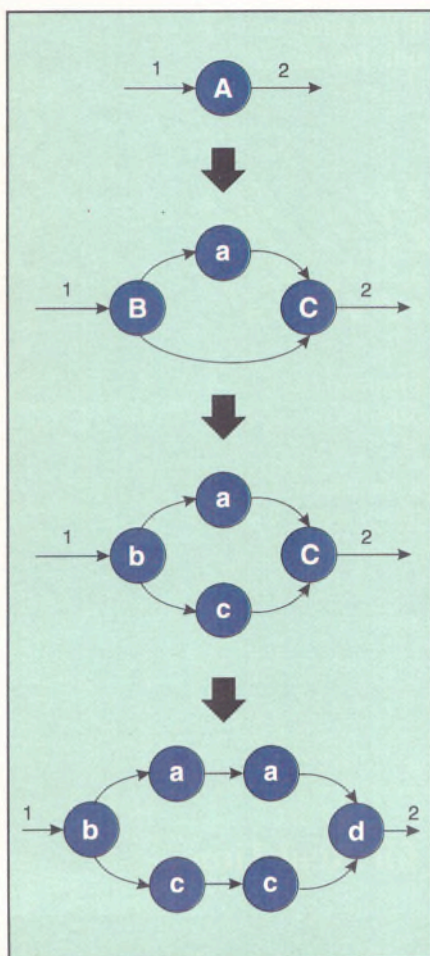


Figure 2 - Derivation of a simple abstraction

Programming clichés can then be recognised when sub-graphs representing those clichés are found in the program's flow graph. This is basically a parsing process, though instead of parsing linear strings the system has to parse a two dimensional graph. Look, for example at the simple grammar shown in Figure 1. This shows a small number of simple production rules (or rewrite rules), which determine how a higher-level abstraction can be derived from a number of lower-level features. The productions are shown in terms of small graphs nodes being program operations, arcs being data flow between the nodes. Any uncon-

We could never accept a grammar which allowed a program to be interpreted by the compiler in more than one way

nected arcs on either side of a production rule are numbered so that the arcs can be mapped across the production (there must be a one to one mapping) and also to take account of the relationship between the sub-graph being parsed and its environment ie the nodes it is connected to.

Terminally yours

Nodes labelled with lowercase letters are terminal symbols ie they may occur in the target language. Whereas those nodes labelled with uppercase letters are non-terminals which do not have an actual representation in the language, but instead encode *concepts* of the language. These principles are directly analogous to traditional languages, eg switch is a terminal symbol in C, whereas statement is a non-terminal (switch possibly being used to derive an instance of statement). The production rule for A states that it is found when the non-terminals B and C, and the terminal symbol a can be found in the flow graph connected by arcs as required by the rule.

Figure 2 shows how the production rules in Figure 1 can be applied to derive an abstraction for a particular flow graph. This process is shown as the derivation tree in Figure 3, which highlights how the recognition of one concept (non-terminal) may then lead on to the recognition of another.

Reality draws in

This example has clearly been simplified by the fact that the production rules are unique; there is only one way to express each non-terminal symbol. In any *real* sys-

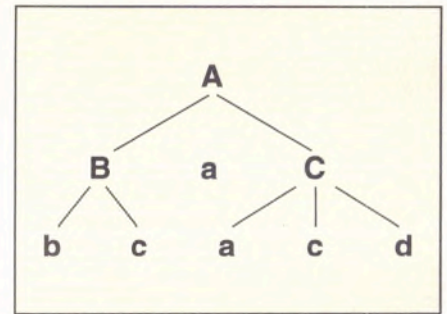


Figure 3 - Derivation tree for Figure 2

tem this would not be the case, since that would mean any abstraction could be implemented in only one way: the whole point of program recognition is that abstractions, such as sort, may have numerous implementations. Also, the grammar shown on Figure 1 contains no ambiguities, - ie there is a one-to-one mapping from the terminal symbols onto non-terminal symbols. In practice this simplification rarely holds, leading to several possible interpretations of a particular flow graph. With a programming language we could never accept a grammar which allowed a program to be interpreted by the compiler in more than one way. It is only acceptable in program recognition because the actual program operation may have many possible interpretations. For example, the addition of 10% to the price could be due to sales tax, a price increase, or a charge for postage.

To assist in the recognition of clichés simple transforms may be applied to the flow graphs. This will allow the program fragments in Figure 4 to be matched.

The flow graphs for the program fragments on Figure 4 are shown in Figure 5 though for simplicity only the data flow relevant to the value of y at the end of the fragments is shown. The first node in the graphs represents the value of x immediately prior to the code fragments shown.

King of the Castle

All program recognition systems, including the two discussed in this article, make use of a hierarchy of abstractions, where low-level plans are used to construct progressively higher-level abstractions. This reduces the size of the knowledge-base since it allows a large degree of information sharing. As a trivial example, once the system is programmed to recognise a number of different methods of doubling a number, for example

```
double(x)
= x + x; double(x) = 2 * x
```

it can use any of the alternatives to recognise a calculation of circumference automatically, for example


```
circumference(r)
= double(r) * pi.
```

The underlying assumption behind program recognition is that programs share common clichés, an assumption supported by the research: a clear-cut case of re-in-

venting the wheel I'm afraid. The systems described here are able to recognise many programming abstractions, particularly sort, search, indexing/hashing, mathematical functions (eg factorial). Another system can even recognise the presence of a symbol table. While these functions are common, which is partly why the systems are pro-

grammed to search for them, there will clearly be significant portions of any program which cannot be recognised.

Tomorrow is another day

Program recognition is still in its infancy. Though a number of interesting prototypes have been demonstrated, they are limited by the language constructs they can handle, and the number of abstractions which may be found. However, progress in this area could yield significant benefits, not least of which would be the ability to fix that oh-so-clever piece of programming you wrote last year... maybe not today, maybe not tomorrow... but *soon* and for the rest of our lives - hurrah!

[1] Harandi M.T. & Ning J.Q. (1990), "Knowledge-Based Program Analysis." *IEEE Software*, Vol. 7, No. 1, 74-81.

[2] Rich C. & Wills L.M. (1990), "Recognizing a Program's Design: A Graph-Parsing Approach." *IEEE Software*, Vol. 7, No. 1, 82-89.

David is an independent computer programmer and consultant specialising in Windows. In an earlier life he programmed in Prolog but now uses Visual Basic and C++. He can be reached on 100112.652@compuserve.com.

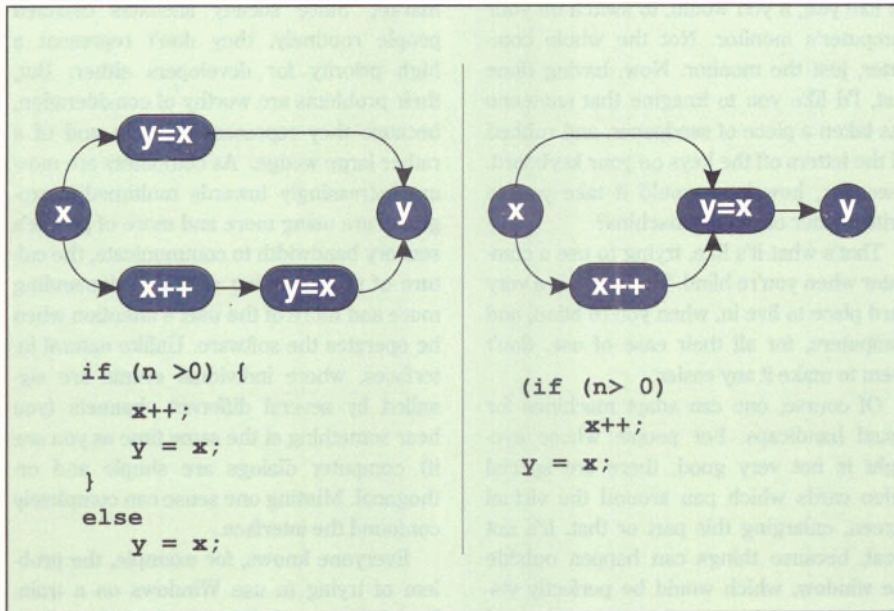


Figure 5 - Flow graphs for Figure 4 (for the value of y)

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Mayhem!

How does a blind person use a computer? **Jules** thinks about the nature of restricted computer interfaces.



I'd like you, if you would, to switch off your computer's monitor. Not the whole computer, just the monitor. Now, having done that, I'd like you to imagine that someone has taken a piece of sandpaper, and rubbed all the letters off the keys on your keyboard. I wonder, how long would it take you to write a letter on such a machine?

That's what it's like, trying to use a computer when you're blind. The world is a very hard place to live in, when you're blind, and computers, for all their ease of use, don't seem to make it any easier.

Of course, one can adapt machines for visual handicaps. For people whose eyesight is not very good, there are special video cards which pan around the virtual screen, enlarging this part or that. It's not ideal, because things can happen outside the window, which would be perfectly visible on a normal screen, but are not noticed by the magnifying screen. For the profoundly blind, there have been speech synthesisers which will read what is on the screen, and which will speak each key as it is pressed. Again, it's hardly ideal: can you imagine trying to write a program that way? But it's something.

Today, things are not so straightforward. We have GUIs, Motif, System 7 and particularly Windows. Since practically all the software which is sold today runs on Windows, the blind are effectively excluded from using computers unless some kind of adaptation can be found. Adaptation is, of course, being done.

The RNIB has a programme to adapt Windows for blind users. Since much of Windows is graphical and text appears all over the screen instead of in the linear structure that DOS used, speech synthesisers cannot solve the problem effectively. Attempts have been made to build tactile screens, using little hammers which move up and down to represent intensity. Text can appear as Braille; graphics as lines. Of course, where each pixel is a little mechanical rod, the screens are very low resolution, small, expensive and unreliable. Although the focus mechanism in Windows can be used to move the 'viewport', the user still has to fish around in large areas to find boundaries. It's still not very satisfactory.

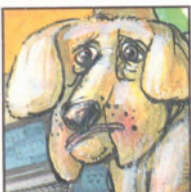
At the expense of seeming heartless, blind computer users are not a very large

market. Since society alienates disabled people routinely, they don't represent a high priority for developers either. But, their problems are worthy of consideration, because they represent the thin end of a rather large wedge. As computers are moving increasingly towards multimedia, programs are using more and more of people's sensory bandwidth to communicate, the culture of programming design is demanding more and more of the user's attention when he operates the software. Unlike natural interfaces, where individual events are signalled by several different channels (you hear something at the same time as you see it) computer dialogs are simple and orthogonal. Missing one sense can completely confound the interface.

Everyone knows, for example, the problem of trying to use Windows on a train. Even when wordprocessing, the absence of an effective mouse is a serious drawback. What of the person with poor motor control, who would be unable to use a mouse on a desk effectively? On a train, with lots of background noise, it's often difficult to hear auditory cues, so error-signifying bongs get lost. The same problem is faced by the deaf. Finally, consider using a navigation program in a car. It's illegal to place a CRT in a car where the driver can see it, so with his hands on the steering wheel and his eyes on the road, the driver is not only blind but also paralysed as far as the program is concerned.

Programmers must be very arrogant people - they seem to demand that your entire attention is directed at their software. Virtual reality, immersive environments, are the same idea stretched still further. But, the fact is that sharing one's attention between a computer and another task is the normal way in which software is used. To regard a missing channel as a disability, or even to disregard it altogether, is to my mind wholly unacceptable. It is exactly in these sparse, non-immersive interactions that computers have their most important roles to play.

It would give few designers any problems to invent an ideal interface for each of my examples. The navigation system could use speech output and grunt detection; the wordprocessor could use outlines to minimise cursor keystrokes, and so on. But my point is that these solutions are all specific





JAKE ABRAMS

to the task, and don't generalise easily. No amount of skill in designing for these specific sparse environments will solve the general problems: those which are represented by disabilities. If computers really are to liberate the disabled then we need a general solution.

And we have one. It's called objects. I've been very critical of technologies like OLE and CORBA because they are solutions looking for problems, and because they introduce gratuitous complexity. But a comprehensive object system, designed into the operating system, and providing extensive user-controlled crossover between channels could solve the problem easily. Research programmes have shown the usability of Earcons embedded in sonic landscapes, of spatial but not graphical workspaces, and of

proactive interfaces. It is possible to build a voice-operated computer with no screen or keyboard, which is just as effective as anything available now and will happily share files with other machines which have no sound capability at all. Not only could these interfaces be made to cooperate, but they could do so inside a single machine, shuffling information from one channel to another. Realtime speech to almost-text, so the profoundly deaf could hear what was being said around them, is possible today.

The disabled have been saying for years that their disabilities are not the problem, but that peoples attitudes are. It's quite true, and those attitudes are getting worse. On the other hand, it's not reasonable to expect a programmer to assume his users will

be disabled without knowing the nature of that disability. So, it shouldn't be the programmer's problem. It should be the operating system's problem. All the programmer should need to do is make the information available to the system.

Trying to make a specific solution for the blind, in isolation of the rest of the industry, is expensive and, ultimately, futile. Finding a general solution will benefit not just all the disabled (a very much larger market), but also those of us who want to use our data while driving, climbing a ladder, sitting on a train, or while answering the telephone. In short, it benefits everyone. ■

Jules' keyboard has lost its legends, his monitor is blank... but he can be contacted on 0707 644185, or on cix as jules.

Apple, get your act together!

Paul Smith takes an unprecedented step  and suggests that those ever-so-trendy Apple folk should stop for a moment and take a leaf out of the Microsoft gospel of software developer support.

I am writing this column a little late, as my wife and I have recently returned from a week's holiday in which we tried to forget about work, computers, and technology in general. We succeeded, but that only made it harder to get started again on our respective returns to work. I've managed to get in gear, at last, and this month the Mac column discusses what developers really need from a developer programme. I'll start with a call for questions...

Notes and queries

From now on, I'd like to encourage readers of this column to send in comments and questions about how to get started on Apple development, and the technical side of development of software or hardware for Apple platforms such as Macintosh, PowerMacintosh and Newton. I can't promise to answer all questions, but hopefully I'll be able to work one or two a month into the column. If you've anything particularly controversial to say, we'll try to print a reply from Apple. Send your comments and questions by electronic mail to Raskexe@ctalk.exnet.com, or by post, email or fax care of the EXE office.

Programme update...

The June column contributed to some ongoing soul searching, in the developer community at large and at Apple UK, about what developers actually need from a developer programme. In my opinion, developers need timely access to information about technological matters and a lot more. It's the 'lot more' that seems to have slipped through the cracks in the last reorganisation of the developer programme. The subject should be receiving more attention from Apple by the time you read this. As well as technical information, developers need to be kept closely in touch with marketing information (software and hardware product availability, pricing, launch plans, and so on). Above all they need regular contact with Apple staff.

For my company, probably the main reason for being a Partner member of the de-

veloper programme was to get better access to Apple UK's product marketing, product management and sales people. We wanted to promote a two-way exchange of information so that, on the one hand, we could synchronise our plans with Apple's marketing efforts, and on the other, we could inform Apple staff about our products and services (which would help sell Apple products) and communicate our point of view.

Apple's failings

For a long time I have suspected that there are a few people at Apple UK who believe that developers are merely taking advantage, riding on Apple's coat-tails and sapping resources. This kind of view has, I am sure, influenced Apple's developer relations over the years. I think the problem may be one of management and education, rather than of resources.

A recent US newsletter for Apple developers quoted a survey which pointed out that the total US market for shrink-wrapped horizontal applications software is in the order of \$5 billion per annum. The market for customised solutions, however, was shown to be around \$50 billion per annum. That's 10 times as big.

My own experience as developer and consultant suggests the disparity is equally true in Europe. This enormous market for customised solutions needs the support of many developers if Apple is to conquer it successfully. To make this happen the developers need to be actively in partnership with Apple.

One Apple person commented that I'm expecting more from Apple than Windows developers get from Microsoft. In some respects, I'm not: the cost of joining the equivalent Microsoft programmes is (to developers) somewhat lower. Microsoft seems to make an effort to ensure developers get value for money.

There is a UK developer conference for Microsoft developers, whereas Apple developers must go to San Jose (which is more fun than Bournemouth, but very expensive). I do think Apple should make a big-

Why is it that the Microsoft/Intel platform is so much more successful than the Apple/Motorola one?



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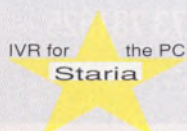
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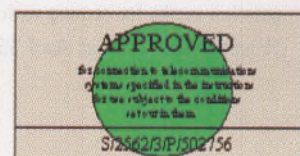
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The future of applications development lies in 'components' which programmers can use time and again. Graphs and charts are part of so many of today's applications that it makes sense to use the same graphing component, especially one which 'gets full marks for coming with so many interfaces' (*Windows Tech Journal*, April '93).

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ger effort than Microsoft to attract and keep its developers. Sometimes we can afford to ignore the failings of Microsoft simply because of the immense market it can offer us.

This begs the question: why is it that the Microsoft/Intel platform is so much more successful than the Apple/Motorola platform? Much has been written on the subject, but I have my own theories about a contributory cause: Apple management's pervasive short-term thinking, and a hunger for quick fixes to problems. Superior technology isn't enough.

Snipped before blossom

Let's look briefly at one example: the Software Dispatch CD distribution system for software. Only one Software Dispatch CD was released in the UK: called the Essentials CD. It didn't contain a brilliant selection of software; new ones for Graphics and Publishing and for Education. It's not particularly surprising that it wasn't successful. But the second Essentials CD, looked likely to be much better. Most new businesses require two to three years to prove themselves: Sometimes it seems like a new Apple business idea has to be wildly successful in its first six months or it gets canned. Everything I have learned in my 15 years in business says the real world doesn't work that way. This kind of event horizon is too short.

The same short-termist approach can be seen in some of Apple's software projects. What has happened, too often, is that a first version of something is shipped, then the development team is wrapped up and moved on to other things, instead of building better second and third versions of the product. This is the case with AppleScript, which is a very good scripting language, but isn't on the same planet (for custom applications development) as Visual Basic. After the development of AppleScript version 1.1, the engineering team was mostly reallocated to OpenDoc development. Now compare this with Microsoft's approach. Which is to build the first attempt and get it out on the market but keep on trying, for three or four major versions over as many years, until it is really right.

Blame the bean counters

I suspect the problem may be to do with how success and failure are measured at Apple. Management techniques that measure only direct profit and loss will reward short-termist views at the expense of the long-term, sustained growth. Perhaps Apple internal reviews concentrate too much on easily calculated quarterly financial performance, ignoring the long term benefits of steady and consistent investment in relationships with third parties? That seems

likely with Apple's developer programmes, which for too long have calculated the cost of supporting developers, without giving Apple's bean counters a mechanism to measure the long term benefits of implementing a fair, consistent, comprehensive and supportive programme. The whole company

I suspect the problem may be to do with how success and failure are measured at Apple. Management techniques that measure only direct profit and loss will reward short-termist views at the expense of the long-term.

needs to be educated to the fact that being in partnership with a broad spectrum of developers really does help sell Apple products. It will build a foundation on which Apple's success in three to five years time will depend. I know Apple can do it: the company has reinvented itself more than once before. This would be a comparatively small shift in emphasis compared to some of the other ongoing transitions.

Develop-o-Ware

While it's pretty much a lost cause getting developer support out of Apple, those wishing to write for the Mac have pursued other avenues successfully. An essential source of information to many is the Internet, with newsgroups such as `comp.sys.mac.digest` and `comp.sys.mac.programmer` and FTP servers such as the Info-Mac server at Stanford University. However, not every developer has access to these sources of information. And no developer has enough time to download and sort through everything that might be of interest.

So it is welcome that CD anthologies of information and software gathered from the Internet are now available. One of the first of these CDs was the Info Mac series, from Pacific HiTech Inc in Salt Lake City, Utah. The fourth Info Mac CD is now available. Like its predecessors (issued about twice a year) it contains a massive collection of shareware and freeware software downloaded from the Info-Mac FTP server, ranging from useful applications, INITs, demos, graphics, sounds, QuickTime movies and HyperCard stacks, to an-

thologies of Internet periodicals.

Pacific HiTech has also launched CDs containing anthologies of HyperCard stacks and of Macintosh games. But of particular interest to the readers of this column will be the two CDs that contain sample source code and programming language tools. Developers always need more sample source code (why invent something from first principles if there is a working code fragment to learn from?) so these CDs should prove invaluable. One is published by Pacific HiTech and the other, the Apprentice CD, is published by the Celestin Company of Port Townsend, Washington. The Apprentice CD holds some 450 MB of source code, useful libraries, and even complete programming languages such as Icon (which I wrote about in EXE a couple of years ago), C, Oberon, and more. Some of the source code examples are a little spotty. You are not going to find an example for absolutely everything you'll ever need to do and the disk organisation and the user interface for the browser that indexes the contents of the CD is very poor. But for the price I can't argue: it's excellent value.

I got my Pacific HiTech and Celestin CDs from Network Analysis Ltd of Coventry, contactable by phone on (0203) 419996 or by email at sales@network-analysis.ltd.co.uk. The price of each CD is (at the time of writing) a reasonable £25.

Coming soon...

To wrap up this month's column: a word about Object Master, which is an integrated browser/editor for object-oriented programming. Object Master works with an external compilation system, such as MPW/ToolServer, or Symantec C/C++, and in my opinion it beats the pants off environments like the Symantec one.

Since I started using Object Master a couple of months ago my programming productivity has significantly improved, which is so gratifying that I want to share the reason with you. I will describe Object Master in a forthcoming edition of EXE. But, for next month I'll be reviewing the new Symantec C++ 7.0 compiler.

Paul G Smith is a software developer and software project management consultant specialising in Apple and Windows development. His company recently shipped ScriptWizard, the first debugger and integrated scripting tool for AppleScript. He can be contacted by email at paul@ctalk.exnet.com, or (if you prefer) by phone at 0727 844232. To submit questions and comments please email them to askexe@ctalk.exnet.com.

Anarchy in parameter land

When is a reference
not a reference? When
it's a... Oh dear. Time to ask
Francis Glassborow.



A few weeks ago I was browsing through the programming books in my local branch of Blackwell's Bookshop when I noticed someone struggling to make sense of the large selection of books on C++. Being the kind of person I am, I barged in and enquired if I could help. The result was that we got talking about differences between C and C++. My 'victim' was a professional C programmer dabbling in C++. He commented on the problem of reference parameters making it difficult for the programmer to know if the called function might change a value.

This seems to be a common fear with C programmers moving to C++. Most books seem to brush the problem aside. I have even seen an author claim that you should pass objects by reference and values by value. Fine if you know what it means but for most that injunction leaves the average programmer confused - when is something an 'object' and when is it a 'value'?

Putting that awkward question to one side and focusing on the main issue, functions need parameters for two reasons. First, they need information to use. Second, they need locations where information can be changed.

C's easy peasey

Many C programmers are very vague about the facilities available in ISO C to support information passing. I am therefore going to start by writing about information passing in C.

Fundamentally we have two distinct problems to deal with; economy in use of re-

sources and security of data. The question of economy hardly enters into the matter for built-in types in C. So there is little difference in the space taken by a pointer and a value, although using a pointer might incur overheads for dereferencing. When it comes to information stored in an array, C appears to give us no choice. The only time that we need to consider economy is when managing information stored in a **struct** - we can either pass by value or use a pointer. Our choice will be determined by considerations of space and time. When passing by value space will have to be found for the value and it will have to be copied into that space. Using a pointer will probably require less storage and save in copying time, but will incur a cost every time the pointer has to be dereferenced (possibly some code space as well as execution time).

We have a very simple decision for built-in types. If we just want the value for internal use by the function we use a value parameter. If we need to change the original, for example when writing a swap function, we use pointers.

For many programmers that is where the decision finishes but even here we should consider possible problems with maintenance. If we believe that it would be a fault to change the value even on a local basis then we should use a **const** qualifier in declaring the parameter.

Once an array, always a ptr

When passing information stored in an array we appear to have no choice: we have to pass a pointer. The mechanisms of array

When passing information
stored in an array we
appear to have no choice:
we have to pass a pointer.

```
void fn (    int * ip,    int * const array)
{
    int localarray[10];
    ip=localarray;        /* valid */
    array= localarray;     /* invalid code */
}
```

Figure 1 - Changing where a pointer points

handling in C means that the local syntax will be consistent between a local array and remote array handled with a pointer. But there are choices that programmers should consider. The first is that if you genuinely want remote arrays to be like local ones you must use a `const` pointer. In Figure 1, for example, because `ip` is not declared `const` you can change where it points to. Something you cannot do with the identifier for a true array. Robust code will always protect parameters handling arrays by making them `* const`.

The second issue which is also too often ignored by otherwise competent programmers is that of making arrays explicitly read only. Make sure that your pointer is pointing to `const` data unless you want to allow the data to be changed.

Note how useful `const` is, but also note how careful you have to be to place it the appropriate side of the `*`.

Information stored in a `struct` can be passed by value in C, though efficiency would normally suggest using a pointer. Everything I have said about pointers to arrays also applies if you use pointers to handle a `struct`. In Figure 2, for example, there is an added complication in that the syntax of handling information in a `struct` through a pointer is different from the syntax when using a value - you have to dereference the pointer explicitly every time you use it.

Confusion of reference

To manage information passing effectively in C++ you must understand the significance of reference parameters. Whatever the original reasons for introducing references into C++ they now serve two different purposes. First they allow us to use an object by different identifiers. Second, they allow us to hide the pointers used by C. Not recognising these two distinct uses is the

cause of much of the confusion in the minds of inexperienced C++ programmers.

Looking at values rather than objects, you have two methods of passing values. There is, of course, the original C pass-by-value and the new C++ pass by `const` reference. Note that `const` in there: too many authors and trainers fail to emphasise it. From the call location, passing by value or by `const` reference is deliberately transparent. You cannot tell which is happening from inspecting the calling code, nor do you have to, because the call cannot change

To manage information passing effectively in C++ you must understand the significance of reference parameters.

the original from which the value has been derived: always assuming you do not insanely cast away the `const` in the body of the function. The writer of the called function can change the declaration back and forth between value and `const` reference. The only effect will be on the efficiency of the code.

I know this is something of an over simplification but it makes the point that programmers should not worry about knowing if values may be accidentally changed. The astute amongst you will realise that a value parameter can be changed locally while a `const` reference parameter cannot. If you want to change the value of a parameter locally within a function you will need to pass by value. It is no good passing by reference because the changes will not be local, but to the original object.

When data must be changed

Now we must face the problem of tackling mutable information ie the function can change the original. In a true object-oriented context you will pass by reference because you will want to pass the object around not just use a copy. If you are not concerned with an object, either because you are dealing with something that is semantically value based or because you are not using C++ for OOP, you may feel unhappy with using a reference because you feel that the calling code should take explicit steps to obtain an address. In other words if you want the possibility of change explicitly visible at the call site you cannot use a reference parameter.

In these circumstances, use the C method and pass a pointer. Of course you do not want to dereference repeatedly the pointer within the function, but C++ has an answer, a local reference variable initialised to the dereferenced pointer. For example:

```
void func (sometype * sp){
    sometype & s= *sp;
    // the rest of the function
}
```

Another instance where you should pass information via a pointer is when the information location is going to be stored in a structure for later use. A good example is building a linked list. You can use references because C++ actually implements references as hidden pointers, but doing so hides possibly important detail from the programmer and can result in accidentally writing an unintended copy constructor.

Having to use the address operator when calling a function with a pointer parameter will remind you that this storage is subject either to alteration or to being kept for later use.

Trust? No kidding...

In both C and C++ use `const` in parameter declarations to provide robust code that is safe for both the user and maintainer of the function. Traditional C programmers have great problems with `const` but 'trust the programmer' can be overdone when the results are counter-intuitive. For example, literal strings in C are not read-only. If they were they could not be passed to many Standard Library functions because they take `char *` not `const char *`. Even better would be `const` pointers but many implementations change the values of pointer parameters.

In C++ think carefully about the advantages and disadvantages of both reference and pointer parameters. Choose the one that is appropriate to the context. To me, this is a far more important consideration than many of the layout and naming conventions that many spend so much time advocating. And finally, be very careful in C++ if you explicitly cast a parameter in the body of a function, the results may work locally but will probably have unexpected results elsewhere.

Subscriptions: individual £12, student £6, corporate £75, Overload & C++ SIG £15 (+membership). For further information about ACCU write to Francis Glassborow, 64 Southfield Road, Oxford, OX4 1PA, ring 0865 246490 or email francis@robinton.demon.co.uk.

```
struct Record {
    /* declaration of data fields
    */
}

void PrintRecord ( const Record * r){
    /* code to display a record */
}

But

void ReadRecord (Record * r){
    /* code to read in a record */
}
```

Figure 2 - Must dereference the pointer

You wanna know my password...

Having taken to hash,
Clipper and
challenge/response, **Peter
Collinson** talks Unix password
security.



One of the earliest articles that I wrote for EXE extolled the virtues of choosing your login password carefully (EXE October 1990). I guess that one of the most frequently asked questions of Unix system administrators is 'can you tell me my password, please.' People are often surprised when they are told 'no'. Of course, the stock answer is 'the password is encrypted and all I can do is change it'.

No encryption. Eh?

Strictly speaking, the Unix password mechanism doesn't use encryption. The technique that it uses is more properly called a *secure hash encoding*. The program that stores your password puts the text through a function that translates the password into a number of characters (13 on my machine) that are stored in the password file. The key thing for security is that you cannot take these characters and derive the original password.

When you tell the system your password on login, the password string that you supply is passed through the function again and the result compared with the text that is stored. If the text matches, you are authorised and login proceeds.

This technique has been okay for a number of years. As processors have got faster, it has become ever more possible to crack passwords by exhaustive techniques, passing choices for the password through the algorithm and testing the result. My original article pointed out that people who did this got a very high hit rate - around 25% of the passwords on a machine was average. Finally, someone implemented a brute force password cracker running on a very fast parallel machine. They could test all combinations of six upper and lower case letters in about one minute.

All this has resulted in password files becoming a target for hackers. If they can get your password file, then they can apply brute force and guesswork to crack your password. The response to this from the industry has been to implement shadow password files. It was realised that all the programs that need access to the user's

hashed password are run as the super user. So it is possible to move the password from `/etc/passwd` into a more secure file that only root can read. The attention of hackers has turned elsewhere. That elsewhere is possibly the Internet.

Don't look. Here's my new pwd

If your machine is connected to a network and you do remote logins, then passwords are being passed over the wire in plain text all the time. Every time that you login, the program on the host asks you for a password and the answering text is passed in plain text to the remote host. In the early days of ethernet at the University of Kent, we refused to put PCs on the same ethernet segment as Unix workstations. We were worried about the ability for anyone to run programs on a PC that inspected every packet that flew by. The consequences of some local hacker capturing a super-user password was uppermost in our minds. Unix workstations tend to demand super-user privilege when a user process wants to have packet level access to the network.

Maybe you are not worried about people on your local network capturing passwords. Last year, someone compromised a router in California. They broke into the router and captured passwords as they went by. I only know of this because I was asked to change my password for some machines on the other side of the router. My reaction was, 'is setting a new password safe? Are they watching for me to run the password program, giving them *two* chances to get my password?' Apparently not, holes had been plugged.

Passing plain text passwords over the net is a bad idea. Can we encrypt all the packets? Hardware encryption is becoming a reality, although people are worried about the speed implications. Even Sun's supposedly secure RPC only encrypts the headers of the packets for this reason, leaving your password still flying over the network in plain text. Another problem here is key dissemination. If I want to encrypt my packets for sending to California, how do I make sure that the receiver has the key needed for decryption?

**Passing plain text
passwords over the net
is a bad idea.**

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Politically correct

Well, public key encryption offers some possibilities here. Public key encryption supplies you with two mathematically related keys. One is public and given out freely, one is private and kept very secret. It allows me to encrypt something with a combination of your public key and my private one, while you decrypt it with a combination of your private key and my public one. The algorithms are slow, so most systems that employ public key encryption use it to send a session key and employ a 'normal' encryption/decryption algorithm to send the data. We seem to be in the early stages of investigating this field. Currently, it's too slow for real time use.

The US government is putting a lot of effort into the development of the 'Clipper' chip designed primarily for realtime phone use. There is considerable controversy over this development largely because of the notion of 'key escrow'. This idea is rather like storing a spare key to your house with a neighbour. A special 'law enforcement key' for each chip will be split and stored with two agencies. A court order will be required to get hold of the key and hence break the code. The 'official' reason is that it will help in the fight against the 'drug barons'. It's fair to say that many Americans are very unhappy about all this. They are far more convinced of the ability of their government to do dark dirty deeds than we seem to be.

So at the moment, encryption of data travelling over the net is not a likely prospect. The main conclusion therefore, is that we need to stop sending passwords over the network as plain text. We need some other method of authentication.

One time passwords

We are trying to stop people passively catching our passwords as they go by. One secure method of encryption is to use a 'one-time' password. Usually, the user is provided with a hand-held unit which will calculate the password so that it can be typed into the machine. One way of doing this is for the hand-held unit to contain an internal clock, a secret key of some sort, and a display. The display shows some function of the current time and the key, changing every minute. The output of the display is never repeated.

When the user tries to login, he types the current value from the hand unit as a password. The host uses the current time and its copy of the user's password to generate what the current one-time password should be. If the computed value matches the one entered by the user, then he is permitted to login. Cheswick and Bellovin, the

authors of *Firewalls and Internet Security* point out that clock skew between the host and the hand-held device is a problem with this scheme and suggest that the host needs to compute several values for possible passwords to allow for this. This introduces another problem: the password could be replayed by a hacker during the clock skew interval. To guard against this, the host needs to cache all passwords received during its lifetime and not permit their reuse.

Cryptographic mathematicians call this problem 'hard' rather than 'impossible'.

A different scheme uses a challenge and a response. The host types something at the user who is logging in and the user responds. The 'something' is different every time. The user has to compute the response in some way. This can be also be done with a hand-held unit, although the unit now needs a keypad. The user types the numeric challenge into the unit and the unit returns a number that is the response. The response is typed into the machine. This is the method used by people in Bell Labs, where Cheswick and Bellovin work.

I have looked at their little hand-help units for some time and wondered how I could implement such a scheme for myself. I wanted something where the response could be generated on my portable PC that I tend to take with me when I leave the premises. This 'something' appears to have been achieved in S/KEY.

Who's challenging who?

S/KEY is a publicly available implementation of a challenge/response login scheme. It was created by Phil Karn, who at the time worked for Bellcore in New Jersey. Bellcore is the research arm of the several separate phone companies that were set up when AT&T was split. Later Phil found that there was a paper proposing the same scheme by Leslie Lamport, although it's believed that Lamport did not build anything. Phil Karn left Bellcore and some other people added to the basic scheme: Neil Haller did some PC clients, Mark Segal worked on Mac Clients and John Walden worked on the Unix end.

S/KEY works by using a secure hash function. The host emits a challenge and the user returns a one-time password that is a 64-bit number. Typing this into the ma-

chine is made easier by translating the number into a series of short words taken from a dictionary.

The one-time password is derived in a clever, yet simple, way. First, the user gives a secret string to the initialisation program. The string acts as their password, it's assumed that this is done from a directly connected terminal. The string is passed through the hash function, say 99 times. Each pass through the function yields a new value. The first one-time password that is used is the 99th iteration through the function, the second is the 98th and so on.

The host validation code has the 99th password stored in a file, and asks for the 98th. The 98th value is entered and is stored, it's passed through the hash function once and this generates the 99th version that was carefully tucked away in a file. If these values match, then the user is allowed in. The 98th password is written to the password file. On the next login, the user will be asked for the 97th password.

Notice how this doesn't need to store the secret string, just the last password in the sequence that was used. Only the user knows their own string. Since the hash function only 'goes one way' from the mathematical viewpoint, if an intruder gets hold of the encoded version then it's useless. There is no way to derive the 97th password from the 98th, unless you are prepared to try all 18,446,744,073,709,551,616 possible one-time passwords. Cryptographic mathematicians call this problem 'hard' rather than 'impossible'.

Thru the digestive tract

So, the initialisation phase of key generation asks for a secret string, adds a random seed to it and passes through the secure hash function several times. The hash function that is used is MD4. This was designed by Ronald Rivest of RSA Data Security Inc. The game in the cryptographic algorithms world is to put your code up for public scrutiny and get others to attempt to break it. This has not been done for MD4, so it is 'believed to be secure'. Even so, Rivest has made a newer algorithm, called MD5 which he created because he felt that MD4 was not sufficiently complex. As I write, a version of S/KEY using MD5 has been made available. I am using the MD4 version.

MD4 and MD5 are 'Message Digest' algorithms. They were designed to take an arbitrary message of an indefinite number of bits and compute a 128-bit value that is the 'cryptographic checksum' (sometimes called the 'digest') of the message. This is used to prove data integrity. MD4 is fast: a necessary feature when you are cycling values though it a number of times.

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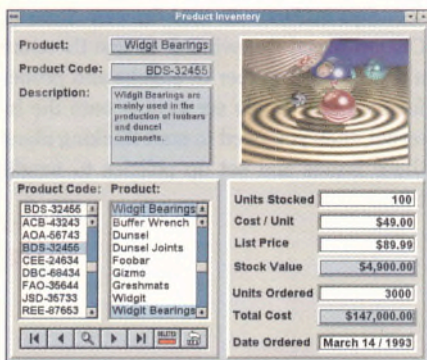
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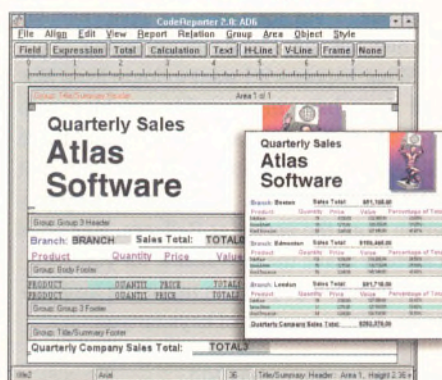
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The S/KEY authors wanted to deal with a 64-bit password, which they reckoned would be sufficient for security. They needed to generate an algorithm that took 64 bits in and spurned out 64, *not* 128 bits. So they took the output from the MD4 algorithm and 'folded' pairs of bytes using an exclusive-or operation, making a 64-bit value.

In practice...

Before I can use the S/KEY system, I must initialise the sequence of S/KEY passwords. This is done by the `keyinit` program.

```
% keyinit
Reminder - Only use this method
        if you are directly
        connected.
If you are using telnet or dial-
in exit with no password and
        use keyinit -s.
Enter secret password:
Again secret password:

ID pc s/key is 99 cr00179
BODE LIAR WALK FINK SO HUE
```

I have folded the lines for printing purposes. It first asks me to add a secret password for S/KEY use, and I enter a phrase. The phrase needs to obey all the normal rules of setting a password and should be a minimum of 10 characters. It then prints the first sequence number/seed pair and tells me the value of the password that is stored. This is expressed as a number of words derived from a dictionary.

I logout and go away. Next time I login to the machine, I do the normal thing of giving my login name:

```
login: pc
```

then, rather than being given the familiar Password prompt, I get something like:

```
s/key 98 cr00179
Password:
```

S/KEY is asking me for the 98th password of mine and also tells me the seed: `cr00179`. I now turn to my portable, which happens to run MS-DOS, and fire up the key program.

```
A: key 98 cr00179
Enter password:
LAID CAKE RAFT JANE LANE FEND
A96C 4F2E 504A A4FE
```

The password that I give this program is my S/KEY secret password that I used to initialise things on the host earlier. The words that are output are typed into the

Unix machine and away I go.

Eventually, I will run out of my 99 passwords and need to reset things. If I am on a secure (directly connected) terminal, I can just rerun `keyinit`. If I am not, then a method is needed to reset the seed without requiring have my real password travel over the network. The `-s` parameter to `key-init` achieves this:

```
% keyinit -s
Updating pc:
Old key: cr00179
Reminder you need the 6 English
        words from the key command.
Enter sequence count from
        1 to 10000: 99
Enter new key
        [default cr001700]:
s/key 99 cr001700
s/key access password:
        SOIL BUSH DANK OIL HAS TO OK
ID pc s/key is 99 cr001700
SOIL BUSH DANK OIL HAS TO OK
```

Again I have wrapped lines for printing purposes. The text in italics is typed by me. The program asks me how many passwords I would like to generate so I choose 99. It then wants a new key and I accept the default one. I am then given a challenge for the new key that I type into my laptop.

What happens if I want to login from afar and don't have my portable machine with me? Well, if I am at a conference and there is a computer available, I can use Internet FTP to pull a relevant binary of the `key` program from the server at Bellcore. FTP sites carefully make these available for you.

Alternatively, you can make the `key` program print a number of keys for you:

```
key -n 5 98 cr001700
Enter secret password:

94: LOAF LOOT CASH HOOD FACT SKIM
95: AVER YE GLOB SALE AIDA KOCH
96: CO OK OK AY NAIR LEEK ARCH
    HELM
97: TOUR RAID ONES TUBA BELL CURL
98: AWK LAW GRUB ITS KNOT SLIM
```

You do need to know the current sequence number and seed to make this happen. You also need to take great care of the paper that you print this on.

Safe from DOS

If you use an MS-DOS terminal emulator to talk to your host, then there are several tools that make logging in a little more automatic. The system comes with some MS-DOS TSR programs. You choose one which then sits in the background waiting for a

hot key to be hit. When that happens, the screen is scanned for the S/KEY prompt and the sequence number and seed found. A window is popped up to ask for S/KEY's secret phrase. The code computes the correct response and sends it to the host by inserting characters at the current cursor position. The user is prompted to send the necessary 'return'.

I said there were a number of TSR's to choose from. The choice depends on the terminal emulator that you are using. The TERMKEY TSR uses the timer interrupt and loads the system's keyboard buffer with the one-time password and the return. The TKEY TSR uses the keyboard interrupt to insert the necessary characters. Some emulators cannot use the timer interrupt. Finally, the POPKEY TSR can be used if neither of these work. It displays the needed one-time password in a separate window. From there it can be typed or perhaps cut-and-pasted into the input data stream. There's a version of this type of semi-automatic login program for the Macintosh too.

Where to go

There are three programs that you need to alter if you go overboard on this system. Sources for the three are available at the archive site, thumper.bellcore.com. They are `login`, the normal login program; `su`, the program that changes from one user to another and `ftpd`, the file transfer daemon. You will also need to install `key-init` and the `key` program. At the archive site you will find contributed sources from a couple of alternative sites, which mostly appear to give you a slightly different user interface to the system. I believe that you will need to tailor the code that is available to fit in with the usage policies at your site.

Finally

Well, I hope that I've given you something to think about when considering Unix login security. In *Firewalls and Internet Security*, Cheswick and Bellovin tell us that there are a continuous number of attacks and probes for their site. If you are getting onto the Internet, then you need to start thinking about these issues and set up policies to handle them.

Peter Collinson is a freelance consultant specialising in Unix. He can be reached electronically as pc@hillside.co.uk or you can look at his WWW server <http://www.hillside.co.uk>.

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A Recipe for good X

Part II

Building on last month's
'Hello World', Niall
Mansfield pops in a popup to
make a utility he owns up to
using himself.



In this article we're going to build a Motif-based menu system. Even though it's a small and simple program, it's also very useful. At our site we use a variant of it every day for lots of simple tasks: system admin jobs like duplicating floppy disks, giving commands to the tape system, etc. In fact it's great for any job which needs to be done often, where typing the command is long or tedious, or just to give non-computer specialists access to useful facilities without having to worry about low-level Unix commands.

The menu program is an extension of the program we developed in the previous article. That had a single push button. Every time it was pressed it called a function we wrote ourselves. To expand this to handle multiple buttons we have to introduce some new Motif concepts. Most importantly, because we have more than one user-interface object in the program, we need some way to control how they are laid out. In effect, we need a box to put all the objects into. For this, Motif has the concept of a 'container' or *manager* widget, which handles the layout of its children. Schematically, we are building a widget tree as illustrated in Figure 1.

The only part of this that isn't obvious is the *application shell widget*. As we mentioned in the last article, this is the application's main window: everything else is contained within it. The shell widget can only handle exactly one child. That's why we have to use a manager widget if we are to have multiple buttons. The easiest manager or container to use is the Motif RowColumn widget. As its name suggests, it can lay out its children in rows, in columns, or both, ie in an array. You specify by means of resources what the layout policy is to be. Now let's write the simplest program possible. The listing is in Figure 2.

This is just like our program from last month, except we create a RowColumn widget *rocol* as the (only) child of the top level shell *mytop*, and then create two children, *pb1* and *pb2* as children of *rocol*.

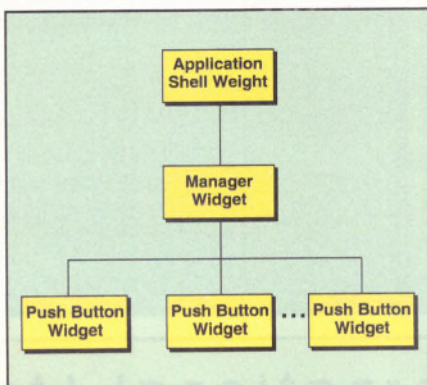


Figure 1 - A widget tree controls the layout

```

#include <Xm/PushButton.h>
#include <Xm/RowColumn.h>
#include <stdio.h>
main(argc, argv)
    int argc;
    char **argv;
{
    Widget mytop, rocol,
    pb1,
    pb2;
    Widget XtAppInitialize();
    XtAppContext myappc;
    mytop =
        XtAppInitialize

    (
        &myappc, "Menuprog",
        NULL, 0, &argc, argv,

        NULL, NULL, 0
    );
    rocol = XmCreateRowColumn

    (
        mytop, "mybox",

        NULL, 0
    );
    XtManageChild(rocol);
    pb1 = XmCreatePushButton

    (
        rocol, "butone",

        NULL, 0
    );
    XtManageChild(pb1);
    pb2 = XmCreatePushButton

    (
        rocol,

        "butttwo", NULL, 0
    );
    XtManageChild(pb2);
    XtRealizeWidget(mytop);
    XtAppMainLoop(myappc);
}
  
```

Figure 2 - Program to produce RowColumn widget with two push buttons

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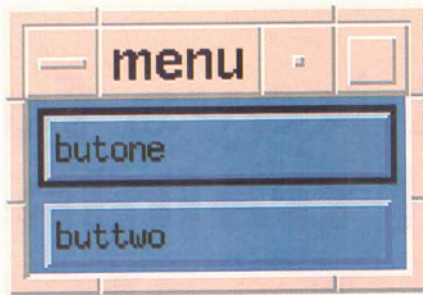


Figure 3 - Output from program in Figure 2

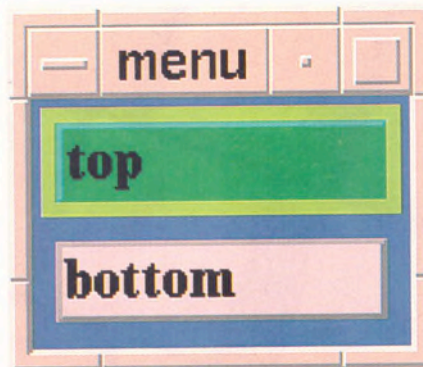


Figure 4 - Cosmetic resource tweaks improve appearance somewhat

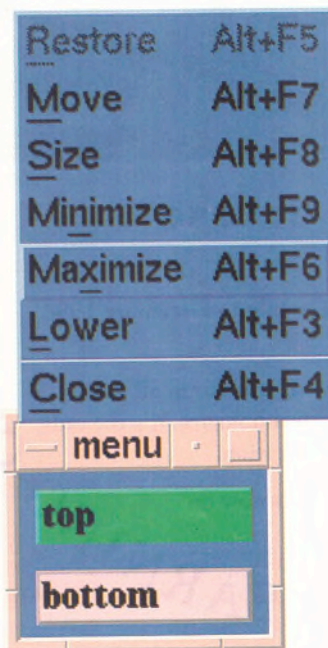


Figure 5 - A popup system menu

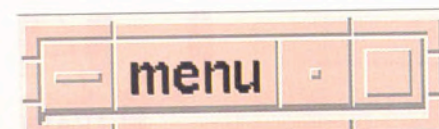


Figure 6 - When you forget to XtMangageChild()...

When you compile and run this program, it generates the window of Figure 3. A nice feature is that even though you didn't say what layout to use, the RowColumn widget defaulted to something sensible ie columnar layout.

Motif is like Microsoft Windows

Though small, this program illustrates a number of ways in which Motif resembles Microsoft Windows. But just before looking at that, first, improve the appearance of your program by creating a resource file, called Menuprog in your home directory. Note that you call it 'Menuprog' because that is the application class name of your program, as defined in the XtAppInitialize line. It is used to locate resource settings for this program.

! Resources for our small menu program

```
*butone.labelString:    top
*butone.background:    green

*butttwo.labelString:   bottom
*butttwo.background:   pink

*fontList:              *Times*-r*-180-*
*highlightColor:        yellow
*highlightThickness:    5
```

Now when you run the menu program, you get something altogether more colourful as shown in Figure 4.

What you've done here, apart from the obvious, is set to yellow the highlight region which Motif uses to mark the 'active' widget in the application (or as we in the trade say, the one which 'has the focus'). In practical terms, the button highlighted is the one which will be activated when you press the spacebar. Go on, try it! The last line of the resource file made the highlight region wider than usual (five pixels wide) so you can see it more easily.

Now press the up-arrow and down-arrow (or left- and right-arrow) cursor keys. You see that the highlight region moves to a different button, and that it is always the highlighted button that the space-bar activates.

While you're at it, try the controls in the top border of the window. As with OS/2, the dot iconifies (minimises) the window, the square maximises it, and the left box gives you a pop-up menu as shown in Figure 5. You can also invoke these with more or less the usual MS-Windows keys (Alt-F4, etc). If you have a phobia for mice, even the control menu is available from the keyboard using Shift-Escape, and Escape to dismiss it.

Some deliberate mistakes

Even though this program is tiny, when writing it from scratch (as opposed to copying it verbatim from me) there's still lots of

scope for errors. First, remember that any time you introduce a new Motif widget type into your program, you must include the appropriate header file (Xm/RowColumn.h here). If you forget this, you will usually get warnings such as 'illegal combination of pointer and integer...'

Second, each time you create a widget, remember to call XtManageChild() for it, otherwise it just won't appear. For example, if you comment out the line where rocol is managed and recompile, when you run the program no errors are printed, but the screen output will look very much like that in Figure 6.

Third, if you forgot to create the rocol widget but still specified it as the parent of

Motif has the concept of a 'container' or manager widget, which handles the layout of its children.

push buttons, you'd probably get a core dump when you ran the program. This type of error is very easy to make when you are modifying an existing program and adding new widgets into it.

Finally, if you create your resource file with the wrong name, such as if you called it 'menu' instead of 'Menuprog' in the example here, the resources settings would not be picked up. The program runs, but doesn't have the appearance you want.

A Real Menu Program

Now you have done enough groundwork to be able to build a useful menu program. It will operate by reading in lines from the standard input. The first word on each line is the label for a button. The rest represents a command to be executed by a shell, using the standard Unix system call system(2). For example, as a quick way to set the X screen background, which we often need to do when taking screendumps, we use the menu input file listed in Figure 7.

The 'grid' pattern is one we created ourselves using the standard X program bitmap; when this is used as a root window background (see Figure 8) it makes it easy to check the size and position of windows. The 'blank' line blanks the screen, by causing the screen saver to kick in after one second of no screen activity. Wait two seconds, then set the screen saver activation period back to normal.

To process a file like this we will need to create one button per menu line and register a callback for the button to make it execute the system call with the appropriate argument. We'll also add in a few cosmetic

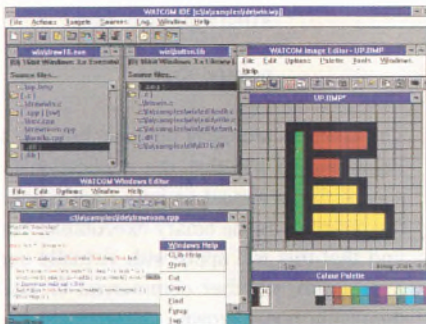
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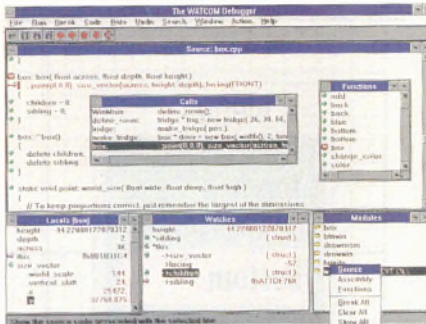
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```

#include <Xm/Label.h>
#include <Xm/Separator.h>
#include <Xm/PushB.h>
#include <Xm/RowColumn.h>
#include <stdio.h>

#define MAX_LINE_LENGTH 1000
#define MAX_N_BUTTONS 50

do_shell_command(w, s)
Widget w;
String s;
{
    system(s);
}

quit_cb(w)
Widget w;
{
    exit(0);
}

main(argc, argv)
int argc;
char **argv;
{
    Widget mytop, rocol, lab,
        sep1, sep2, qbut;
    Widget XtAppInitialize();
    XtAppContext myappc;
    char buf[MAX_LINE_LENGTH];
    Widget buttons[MAX_N_BUTTONS];
    short n_buttons = 0;

    mytop = XtAppInitialize(
        &myappc,
        "Menuprog",
        NULL, 0,
        &argc, argv,
        NULL,
        NULL, 0);
    rocol = XmCreateRowColumn(
        mytop,
        "mybox",
        NULL, 0);
    XtManageChild(rocol);
    lab = XmCreateLabel(
        rocol,
        "proglab",
        NULL, 0);
    XtManageChild(lab);
    sep1 = XmCreateSeparator(
        rocol,
        "topsep",
        NULL, 0);
    XtManageChild(sep1);
    while (gets(buf) != NULL)
    {
        char
            this_la-
            bel[MAX_LINE_LENGTH];
        char *this_cmd;
        short i = 0;

        strcpy(this_label, buf);
        while (!isspace
            (this_label[i]))
            i++; /* first word */
        /* terminate the label */
        this_label[i] = '\0';
        /* rest of line is command */
        this_cmd = buf + i + 1;

        buttons[n_buttons] =
            XmCreatePushButton(rocol,
                this_label, NULL,
                0);
        XtAddCallback(
            buttons[n_buttons],
            XmNactivateCallback,
            do_shell_command,
            strsave(this_cmd));
        n_buttons++;
    }
    XtManageChildren(buttons,
        n_buttons);
    sep2 = XmCreateSeparator(rocol,
        "botsep", NULL, 0);
    XtManageChild(sep2);
    qbut = XmCreatePushButton(rocol,
        "Quit", NULL, 0);
    XtAddCallback(qbut,
        XmNactivateCallback,
        quit_cb, NULL);
    XtManageChild(qbut);
    XtRealizeWidget(mytop);
    XtAppMainLoop(myappc);
}

```

Figure 9 - Doing something useful with a popup menu

features, such as a label, separator bars above and below, the buttons and a 'quit' button. The code is given in Figure 9. Figure 10 is the result.

First, we've included the header files for the new widget types (Separator and Label) that we are now using. Then we have the single callback function `do_shell_command()` which will be used by each menu button. All it has to do is invoke `system()` on its string argument. This argument is the `clientdata` information passed to the callback function when the Toolkit invokes it. The value of this `clientdata` is whatever we specify when we register the callback in the first place. That's followed by

the callback function that we will use for the quit button.

In the main routine we create and manage a label widget and a separator widget. (By now you will have guessed that widgets are arranged in the RowColumn container in the order in which they are added.) Then we read in each line, chop off the first word of it for use as this push button widget's name, leaving the rest as the shell command to be executed. Then we create the button as one in an array of buttons, and register its callback function, specifying the shell command string as the `clientdata` to be used when this button's callback is invoked. When all the buttons are created, we

use `XtManageChildren` to tell rocol about all its children, and away we go. (We could have used an `XtManageChild` within the loop for each separate button, but where you have multiple widgets like here, `XtManageChildren` is more efficient.) Finally, we create the bottom separator and create the quit button and register its callback.

We now need to extend the resources file to handle the new components we've included in the program:

The application's resource file is almost as important a part of the program as the binary executable

```

! Resources for our small menu program
*fontList:*Times*-r*-180-*
*highlightColor:        yellow
*highlightThickness:    5

*.XmPushButton.background:
                        light blue
*.Quit.background:      red
*.Quit.fontList:*Helv*-o*-180-*

*.XmSeparator.foreground:white
*.topsep.separatorType:
                        SINGLE_DASHED_LINE
*.botsep.separatorType:
                        DOUBLE_LINE

```

The changes are fairly obvious, but you are beginning to see that the application's resource file is almost as important a part of the program as the binary executable. You'll find that this will apply with virtually every X program, whether commercial or public domain or home grown.

There are two tricky points in the C code. First, when we specified the cli-

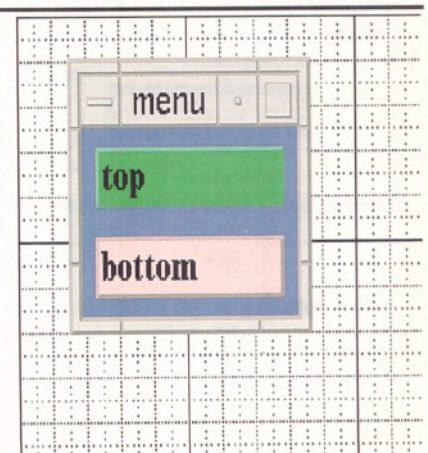


Figure 8 - The grid background helps to align and size windows


```
gray xsetroot -bitmap /usr/X11R5/include/X11/bitmaps/gray3
mit xsetroot -bitmap /usr/X11R5/include/X11/bitmaps/menusetmanus
white xsetroot -solid white
blue xsetroot -solid lightblue
grid xsetroot -bitmap $HOME/etc/grid
(blank) xset s 1; sleep 2; xset s on
```

Figure 7 - A quick way to set X screen backgrounds

entdata in the `XtAddCallback()` we made a copy of the string and pass a pointer to the copy `strsave(this_cmd)` rather than using 'this_cmd' itself. The reason is that you really are just passing a pointer and the string is not copied internally. If you didn't copy the string explicitly yourself, each button would be using the same pointer and therefore the same (probably wrong) value for its command string. Second, the way we split the line into words isn't very rigorous (what happens when the link starts with a space, or is blank, or just a single word?). But that's not Motif programming so you can fix it yourself.

Where to go from here

Experiment with this program. What happens when you resize the window, when you make it short and wide, or tall and wide? Look at the RowColumn resources

`XmNpacking,` `XmNnumColumns,`
`XmNisAligned` and `XmNentryAlignment`. If you include the line

```
*traversalOn: FALSE
```

in your resource file, what effect does it have on using the cursor arrow keys, or on using the space-bar to activate a button?

In the next article we'll make this program more sophisticated in a number of ways. We'll use a proper pull-down menu bar, so you can group several menus into one program. We'll add 'dialogs', for asking the user to confirm important actions, and (if there's room) we'll allow graphic icons on the buttons, not just text.

Niall Mansfield is Managing Director of User Interface Technologies Ltd, email: ni-all@uit.co.uk.

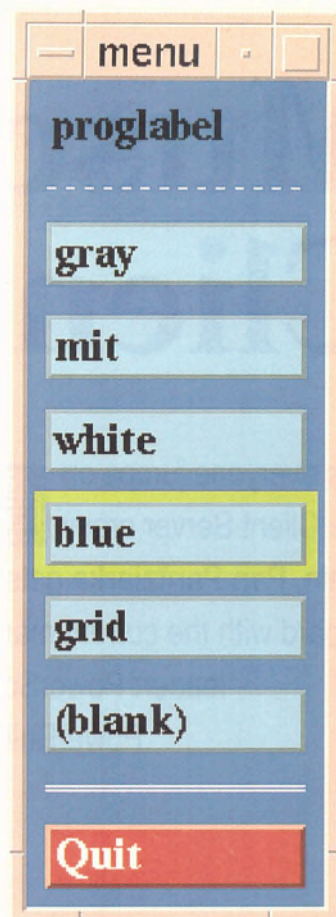


Figure 10 - A useful popup...

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Muscling in to Client/Server

As everyone jumps on the Client Server gravy train, **Pan Pantziarka** gets on board with the current market leader: PowerSoft's PowerBuilder



There can be little doubt that the current bandwagon in computing is Client/Server. Not a day goes by without new products being announced, and existing products being geared up to it. If you think this sounds like an exaggeration: look at the figures. The investment in the market is phenomenal, with all major hardware and software vendors jockeying for position at present.

Which is probably how we've arrived at the situation where anything that can run on a network is sold as a Client/Server product. However, whilst the marketing guys would be more than happy to have us believe that we've finally found the ideal solution, more and more people are coming to the conclusion that Client/Server is not *quite* the cost effective miracle that has been claimed: that it can actually be a very expensive way to go. Partly this has been because effective Client/Server products require the right set of tools to develop them, which is where PowerBuilder, produced by the PowerSoft Corp in the States, comes in. Having just reported record revenue for the first quarter of this year, up 300% on the same period last year, PowerSoft is already

reaping the benefits of offering genuine Client/Server development tools to a market that is crying out for them: which is presumably why they're shifting so many units.

PowerWhat?

According to the blurb, PowerBuilder 3.0 is a Desktop Client Server Development Tool. In English this means that it is a set of tools for the designing of the client side, the front end, that runs on your PC, of applications which access data stored in relational database servers somewhere 'out there'. These can be on the same PC, on a network server or safely locked up on a mainframe somewhere down the line. PowerBuilder is for building the forms and tools which allow the user to connect to, and use, the data that sits in a third party database. This *isn't* MS Access or Paradox for Windows, the database server or engine is not really part of the package. Conveniently PowerSoft does supply a server for use when doing development, the Watcom SQL Server comes with the package and provides a fully featured SQL database management system to be used when developing applications.

PowerBuilder also includes other elements such as a Menu Painter for designing drop down menus. There are also tools for interfacing directly to your target database for admin tasks. As with any decent development environment, a debugger is included to help with testing and fixing problems.

Dream Data

PowerBuilder provides you with a DataWindow which is the interface to your database, and as such is probably the most important element of any application you create. Data can be retrieved and stored using this form by generating interactively the SQL to be submitted to the database server, so it has to be an extremely flexible mechanism and easy for the end-user to negotiate. PowerBuilder scores well here; the DataWindow objects are easy to configure and adapt to suit requirements. In fact the reports painter and the data window are exactly the same, apart from the fact that the reports

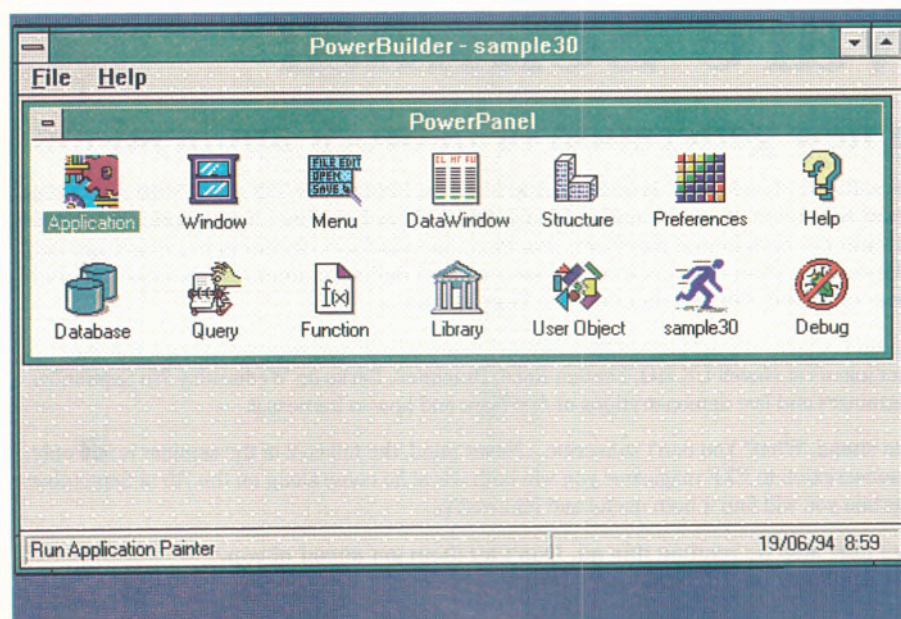




Figure 1 - Getting started with the PowerPanel

The Database Programmers Retreat

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Preparing for VO - 2 Days

This class also gives you hands on VO experience, but the emphasis here is on preparing your existing applications for VO and Windows. You'll learn about object oriented and event driven programming, designing Windows user interfaces, and MDI applications. You'll import some existing Clipper code to VO, learn how to optimise it, and how to enhance it to take advantage of Windows. We'll also show you how to create Windows database applications from scratch, using VO's screen and menu painters.

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In this seminar we'll take you on a guided tour of VO. We'll explain the VO approach to Windows development, the tools, the language and the environment. We'll show you what's involved in moving existing Clipper code to Windows and VO, and how to create Windows applications from scratch. If you're considering VO, or Visual Basic, Fox or PowerBuilder, this seminar's for you.

About DataBase Programmers' Retreat

Run by members of the original US Nantucket team, the DataBase Programmers' Retreat is located in the heart of England's beautiful Cotswolds countryside. We're easy to reach by rail, car and air, accommodation is very reasonable, and we've got some of the best real ale in Britain. We only teach programmers and we specialise in database programming (Clipper and Visual Basic) All our instructors are active developers with years of both development and teaching experience. We keep our class sizes small (max. 6 students), and each student works on his or her own 486 based PC.

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are read only and cannot write back to the database.

Obviously there is a high degree of iteration involved, with changes as the data windows are previewed, edited and previewed again. An application can be run at any point, which makes for a very interactive development cycle. This is not without its problems though, and the dreaded GPF reared its ugly head on a number of occasions (though not in any way repeatable), but overall PowerBuilder is quite stable.

Once you've honed your application so that it includes multiple data windows, drop down menus, bar charts and all the other goodies that PowerBuilder contains the end result will be a single .EXE file. This is created in much the same way that Visual Basic creates a .EXE file from the forms and codes that make up the application. Selecting the option from the main menu packages up your objects, scripts, icons and so on into a single .EXE file. PowerBuilder enables you to distribute this with the Database Deployment kit, supplied on registration: without having to pay for run-time licenses.

PowerReady, PowerSteady...

To get things started: click on the PowerBuilder icon. This opens the desktop and displays the PowerPanel, (see Figure 1) which is the interface to the various modules that make up the development environment. By the way, you'll get used to the word 'Power' prefixing everything: PowerSoft, PowerBuilder, PowerPanel, PowerBar until you feel positively megalomaniac. Before launching into any of the nitty gritty it's worth clicking on the applications icon and having a good look around the sample appli-

cation supplied by PowerSoft, (see Figure 2). This is in fact a collection of mini-applications each of which illustrates a particular capability of the product. For each of the list of categories on the left hand side, such as DDE, graphs or MDI, there is a choice of applications showing a different aspect of it. The right hand column is a scrollable text box which gives details of the highlighted application.

Buttons, buttons everywhere...

The range of sample applications gives some hint of the capabilities of PowerBuilder, from the CPU timing function to the graphing functions, the DDE to Excel examples. But before overexciting yourself with the range of possibilities the first logical step is to dive in and start producing your own applications. If you're starting from scratch your initial step should be to define and design the database, which is achieved via the Database Painter (invoked from the database icon on the button bar). PowerBuilder features a number of 'painters' - the application painter, the data window painter and so on. These are really self contained forms designers for the different parts of an application. Each painter includes its own button bar, though it has to be said that many of these are over-configured, and have more buttons than can be displayed on a standard VGA screen. The button bars can be configured to add and remove buttons, and the button bars can be positioned on any edge of the screen or made floating, but it's annoying that you have to do that immediately.

The **create table** option from within the database painter is a fairly standard table design form: columns are named, data

types and widths assigned, keys selected etc (see Figure 3). Being a true client/server system the table itself is not created directly by PowerBuilder. Instead, the form is used to generate the SQL statements required to define the database. When ready the SQL can either be submitted to the database server or logged away for later use, documentation or whatever. This process is not limited to the Watcom SQL supplied with PowerBuilder: tables can be created for any of the databases supported, including MS Access and with ODBC support just about anything else too.

Fiddle with pibble

The next stage in building an application is to use the application painter to build an application object. The application painter first prompts for a path and file name to create a .PBL (PB Library or 'pibble') file. Each application is assigned an icon, which is a standard .ICO file, a few of these are supplied with the product but any of the trillions which inhabit your hard disk can be used. Once selected the icon will be used inside the PowerPanel for your application, and it'll be compiled into the .EXE file which can be created once your application is complete.

Predictably the next step, having created the database and the application object, is to add some windows. The window painter workspace features *another* bar with more buttons than Cadbury's, which is hardly surprising given that there are 21 controls to choose from. It's the usual interface when designing a window: click to select a control, click on the window to plonk it down, double-click to set the properties. As shown below, one of the controls is a 'user control': a handy little mechanism for adding custom controls including Visual Basic .VBX files. The user object class also includes an 'external user object' which allows custom controls embedded in DLL files to be incorporated into your application.

Talking Power

In addition to specifying controls and their properties, the window painter is also used to associate scripts and events to your objects. Inevitably the programming language has been named PowerScript, and like Visual Basic, is used to program for different events. With a separate 170 page manual, PowerScript is a simple but, dare I say it, powerful language founded on Basic. This has been deliberately kept at a high level because the purpose of PowerBuilder is to create complex Client/Server applications, not to program at the C source level of Windows. The development environment as a whole creates the applications. The pro-

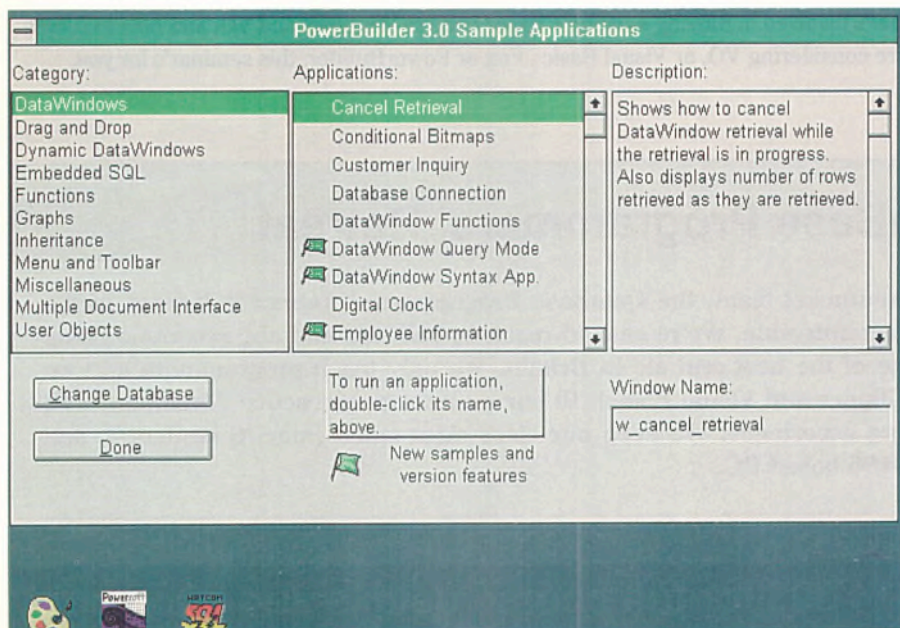
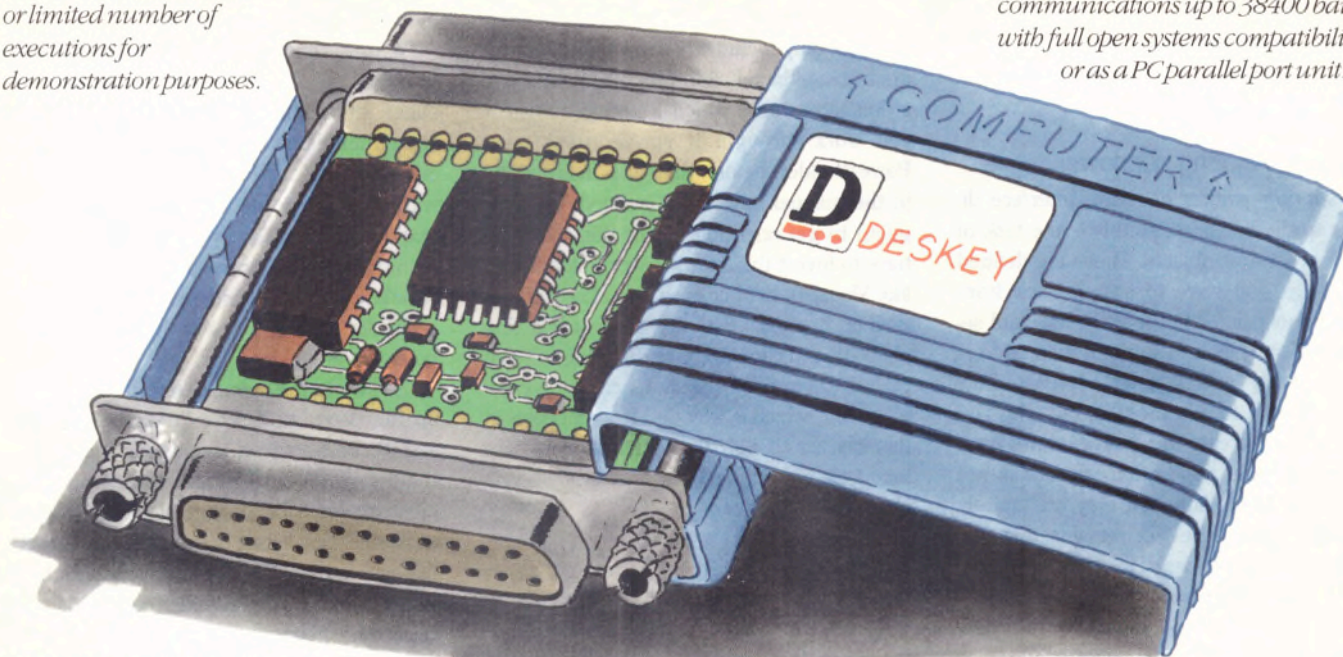


Figure 2 - The sample application supplied by PowerSoft

16 million down counter provides metering ability or limited number of executions for demonstration purposes.

Available as an ASCII device allowing transparent serial communications up to 38400 baud with full open systems compatibility or as a PC parallel port unit.



Encryption capability allows secure data storage or message transmission/authentication.

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When is a dongle not a dongle? When it's a DESkey.



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gramming of the interface is carried out visually so that the PowerScript language need only provide code for the database interactions required.

When I'm Painting Windows...

The window painter does not interface directly to the database, as this is the task of the DataWindow objects. These are defined separately: you have to switch back from the window painter to the PowerBar and select a different icon. It's one of those things that probably makes a lot of sense after you've used it for six months, but why you can't actually create the data windows from inside the main application window is not clear at present. Although they are entirely separate objects, the fact remains that you still want them both *inside* the main window.

Having referred to the manual and clicked through all the menus you can now go ahead and create your data window, or re-use an existing one. The data window level is where you get to look at all the tables in the database defined earlier. The process is fairly straightforward: select the tables and columns, decide on a sort order and then OK it. This is then turned into a DataWindow object, which resembles a report design in MS Access, with bands for header, detail, summary and footer. At this stage the DataWindow can be previewed. If there's data in the table it will be displayed on the screen.

Fools rush...

I'd like to state for the record that the first point of call for *new* users has to be the *Getting Started* manual, the first of the distinc-

tive lilac coloured manuals from the box. This not only includes a section on the very unobtrusive installation process, it contains a detailed tutorial which I strongly suggest you work through. If you've never used PowerBuilder before then the instructions in the manual have to be echoed: if you're going to get anything out of this then you have to invest the effort. PowerBuilder is not like Visual Basic, nor even like Microsoft Access or Borland's Paradox, this is not a simple point and click exercise. Building mission critical Client Server systems can be a complex affair, which is why development costs in this area are so high. PowerBuilder does ease that task but still requires a level of skill above MS Access *et al.*

PowerBackache

Given the kind of task to be tackled it's no great surprise that PowerBuilder is one of those hernia inducing packages that are fast populating the world. The supplied box is only slightly smaller than the full Microsoft Office package in terms of size and weight, so for those techies who need the exercise some Softwarobics using the two boxes might be handy. However, where the MS Office box contains upwards of 35 diskettes, the PowerBuilder box only contains half a dozen, the rest of the space is taken up by the comprehensive documentation. Starting with a 234 paged *Getting Started* manual, the set also includes a heavy weight *User's Guide*, a *Function Reference* and smaller manuals on Watcom SQL, the PowerScript Language, *Report Functions*, *Objects and Controls* and a number of smaller booklets on ODBC, connecting to databases and

building styles and actions.

With so much documentation the quality becomes an issue: having thousands of pages of incomprehensible or badly designed text is no better than having no text at all. Each of the PowerSoft manuals starts with a road map detailing where the information is, organised by topic rather than by manual. Even by topic, such as 'Using PowerBuilder', the road map is organised hierarchically allowing you to home in on the book you are looking for.

As always the online help is there to back up the paper stuff. The PowerBuilder Tips and Techniques icon included in the PowerBuilder group during installation is one useful source of online documentation, providing an alphabetical listing of common problem areas and topics. The context sensitive help called from the PowerBuilder desktop is generally very good, and comes in two flavours 'Getting Started' or 'Technical Help'. These in turn can be enhanced by the use of 'User Help', which is included on one of the buttons on the help screens. This is a mechanism included by PowerSoft for users, (or rather developers), to add their own help screens to the existing online help, creating an integrated online help system.

Build the body beautiful

In a review this size it is not possible to cover everything in adequate detail, but there are some points that I'd like to emphasise. The first is that this is a complex product. Each of the different 'painters' abounds with buttons and options. It can be confusing sometimes to be presented with so many choices, especially as it is not always clear what needs to be set and what can be safely left to default. The aim is to offer the highest degree of flexibility but this seems to have been achieved by losing some elements of simplicity. The design itself is not always clear cut, witness for example the to-ing and fro-ing between windows painter and data windows design. This separation of function only makes sense after you have mastered the intricacies of the PowerBuilder way of working.

These aren't major criticisms: after all you wouldn't trust Client/Server applications development to the gifted amateur. Applications that are mission critical demand the highest professionalism, but it does appear that things could be streamlined. PowerBuilder is, however, without doubt a tool worth mastering, so clear that book shelf space and be prepared for some effort!

PowerBuilder Desktop costs £175 from Grey Matter (Tel: 0364 654100). Pan Pantziarka can be reached on CIX as Pan.

Figure 3 - The create table option from within the database painter

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Message in a wire

Paul Richardson pulls out an IP, speaks to a name server and unravels the mysteries of that Internet work horse, electronic mail.



For many people email is already a way of life. I predict, it will become so for the rest of us. Whether it be a means for communicating within an organisation or further afield, email has proved itself to be a fast and efficient form of communication. I have no doubt that within a decade from now email will be more widely used than fax and will also steal a small amount of voice traffic.

Destination everywhere

How can I be so sure? Well let's compare the pros and cons of email and fax (I am assuming the presence of a network in both cases). For a start, email messages can be routed to and from the desktop. Faxes can be sent *from* the desktop, but a reliable means of directing incoming faxes to the appropriate computer has not yet been found. That is unless you have a Direct-Dial-In capable fax server. Secondly, an email message will arrive at a computer in the same format as when it left. So a file written in, say, Microsoft Word will arrive after emailing as a MS Word document: no retyping is necessary should the recipient wish to edit the file. Faxes, however, arrive only as bit-maps. Also, for the financially challenged a considerable saving in telecommunications costs is potentially available, since email can be transmitted quicker than a fax, even over a dial-up connection. Of course, email is the underpinning technology in most of the new workflow products, whereby documents and forms are passed around an organisation in a predetermined manner with an action to be performed at each stop. This month I'm going to dig below the tranquil surface of Internet email and investigate its inner workings. To do the topic justice, I must first cover some of the fundamental aspects of the Internet that are common to all its services, such as addressing and routing.

Node know how

Every node on the Internet has an assigned unique number, known as its IP (Internet

Protocol) address. I use the word 'node' advisedly, because items such as routers and network printers are also assigned IP addresses. In addition, a node with multiple network connections, such as one ethernet card and a dial-up PPP (Point to Point Protocol) connection will have an IP address assigned for each connection.

The Domain Name System is the glue that binds the Internet together

It is important not to confuse the IP address with a physical address such as those associated with ethernet cards: IP addresses are logical addresses. An IP address is a 32-bit quantity which is split into two parts, a network field and a host field. The network field identifies a physical network, the host field identifies a node on that network.

IP addresses have an additional flexibility in that there are three possible splits between the network and host fields. These different splits are referred to as classes A, B and C, identified by the top three bits as shown in Figure 1. Hence, there are potentially 128 class A networks, 16384 class B networks and 2^{21} class C networks. Class A networks can consist of up to 2^{24} hosts, class B up to 65536 and class C up to 256 (although a couple of addresses are reserved for identifying 'this host' and broadcasting). The host field itself can be split into network and host fields using a technique known as subnetting. This allows for even greater flexibility in allocating the limited number of available IP numbers.

IP addresses are usually represented in a form known as a 'dotted quad' or 'dotted decimal' whereby each group of bytes is represented as a decimal number and separated by a full stop. Thus the class B address:

```
10011110 10011000 00011101
00001100
```

is represented as:

```
158.152.29.12
```

Now it's pretty darn obvious that we can't just grab the first block of addresses that takes our fancy; it has to be centrally administered. The organisation that administers

	0	1	2		7		15		23		31
Class A	0	net					host				
Class B	10	net					host				
Class C	110	net					host				

Figure 1 - IP addresses

the allocation of IP addresses is the Network Information Centre in the USA. However local representatives have been appointed to ease the burden. In the UK, requests for IP address allocation should be made to JIPS, the organisation that administers JANET, the academic network.

Whose domain is it anyway?

While the dotted quad may be easier to remember than an ethernet address, when it comes to indicating where you want your email sent, it still isn't a model of user-friendliness. Fortunately, Internet networks and hosts can be identified by symbolic names. By combining the network and host names, we have a name which can be used to identify uniquely a host on the Internet. This name is known as the Fully Qualified Domain Name (FQDN). An FQDN takes the form:

`host.domain`

where domain itself is represented by:

`domain. [{domain.}]`

So, using my own host's FQDN: `motiv.demon.co.uk`, as an example, **motiv** is the host name and **demon.co.uk** is the domain name. The final dot is usually omitted. These names are not case-sensitive, though people often use case for emphasis.

The rightmost component of an FQDN (`uk` in the example above) is known as the top-level domain. These are the only part of a domain that are prescribed, the rest can be applied for outside of the USA. You will find that the majority of domains have the ISO 2-letter country code as a top-level domain. Within the USA, people prefer to use top-level domains that indicate the type of organisation, such as **.com**, **.gov** and **.edu**. The naming system is designed to be administered hierarchically. This means that the tasks of assigning names and mapping names to IP numbers can be devolved and handled more locally. It is this latter issue of mapping names to IP addresses that we shall investigate more closely.

A name for all occasions

The Domain Name System (DNS) is the glue that binds the Internet together. It is a distributed database of information for each domain on the Internet, that can be queried from any host. It is used primarily to convert host and domain names to IP addresses, but it also stores other information relating to hosts and domains.

Each host on the Internet is usually configured to use a particular DNS server, more usually known as a *nameserver*. DNS queries usually happen transparently to the user. For instance when you supply FTP

Source	Destination	Addresses	Instructions	Notes
America Online	Internet	user@domain	user@domain	
AT&T Mail	Internet	user@domain	internet!domain!user	
BITNET	Internet	user@domain	user%domain@gateway	1
CIX	Internet	user@domain	user@domain	
CompuServe	Internet	user@domain	>INTERNET:user@domain	
FidoNet	Internet	user@domain	user@domain ON 1:1/31	
GNS Gold 400	Internet	user@host	/DD.RFC-822=user(a)host/ O=uknet/PRMD=uk.ac/ ADMD=gold 400/C=GB/	2
Internet	America Online	A User	auser@aol.com	3
Internet	AppleLink	user	user@applelink.apple.com	
Internet	AT&T Mail	user	user@attmail.com	
Internet	BITNET	user@site	user%site.bitnet@gateway	1
Internet	BIX	user	user@bix.com	
Internet	CIX	user	user@cix.compulink.co.uk	
Internet	CompuServe	71234,567	71234,567@CompuServe.com	
Internet	CompuServe	organization: department:user	user@department.organization. compuserve.com	4
Internet	FidoNet	john smith at 1:2/3.4	john.smith@p4.f3.n2.z1.fidonet.org	
Internet	GNS Gold 400	(G:John, I:Q, S:Smith, OU: org_unit, O:org, PRMD:prmd)	john.q.smith@org_unit.org.prmd. gold-400.gb	
Internet	IBM	user@vmnode.tertiary_ domain	user@vmnode.tertiary_ ibm.com	
Internet	MCIMail	John Smith (123-4567)	1234567@mcimail.com or JSmith@mcimail.com	5
Internet	SprintMail	John Smith <user@domain>	To: 'John Smith (EMS)'EMS: 'INTERNET'Mbx:'user@domain'	
SprintMail	Internet	user@domain	(C:USA,A:TELEMAIL,P:INTERNET ,RFC-822": <user(a)domain >) DEL	2
Notes:				
1) where 'gateway' is a gateway host that is on both the Internet and BITNET. Some examples of gateways are cunyvm.cuny.edu and mitvma.mit.edu				
2) for special characters, use @=(a), %=(p), !=(b), "=(q)				
3) all lower-case, remove spaces				
4) This syntax is for use with members of organisations which have a private CompuServe mail area. 'department' may not always be present.				
5) Have to use numerical version if user name is not unique				

Figure 2 - Guide to mailing between networks

with a host name, the first thing it will do is query the nameserver for the corresponding IP address.

As already mentioned, DNS supplies additional information, the most important of which, for this article, is the MX record. MX records indicate where to send mail that is destined for a particular domain. There can be more than one MX record associated with each domain with different preference values. This is important because if the usual mail routing host is unavailable, an alternative can be used. A DNS query for the MX record will be performed by each computer that receives a mail message and the message passed on using the Simple Mail Transfer Protocol (SMTP) to the suggested

host until the mail finally gets through.

The Last Gasp

It's still kind of a half-truth to say that SMTP is used to transfer the mail all the way to the destination host. In actual fact a variety of protocols are used to bridge the last hop depending on the computing environment surrounding the destination. These protocols are:

- SMTP
 - Post Office Protocol (POP)
 - Network File System (NFS)
 - Interactive Mail Access Protocol (IMAP)
- The major distinguishing factor between SMTP and the others is that it is a 'push' protocol. By which I mean that the host

with the mail will attempt to send it without being asked to, hence the destination host must be listening all the time for an SMTP message. By comparison, the other 'pull' protocols act in a Client/Server manner, relying on the destination host to request any new mail to be sent.

This makes using SMTP for the final hop a good choice if the destination host is running a good multi-tasking operating system that is capable of running a background process that simply listens for SMTP messages.

It is because the majority of machines do not run such an operating system that the Post Office Protocol was developed; the latest version of which is POP3. To facilitate shifting the burden of responsibility to the destination host, the POP protocol was implemented such that the server can handle many simultaneous requests to retrieve mail. Also, a minimum of intelligence is required on the part of the client. POP operates over a TCP/IP connection using ASCII messages.

Figure 3 contains an example POP3 session. A more detailed description is given in Laine Stump's article starting on page 34 of this issue.

NFS is a protocol for mounting remote file systems across a network, so some of you may have been surprised that I named NFS as a last hop mail protocol. However it can be used to mount the directory structure remotely such that it holds the incoming mail messages. This is a technique that is often used within an organisation that has a network of workstations. It requires that user names are unique throughout the organisation, but does significantly reduce the amount of administration required to set up and maintain a mail system.

Finally, IMAP is gaining in popularity. It is intended to be used in the same situations as POP, but it actually has much greater flexibility. It is also more suited to slower transmission media and will support shared mailboxes that can be used as the basis of a news service.

server:	<waiting for TCP/IP connection>
client:	<open a connection to server>
server:	+OK POP server ready
client:	USER bod
server:	+OK password required for bod
client:	PASS freda
server:	+OK maildrop has 3 messages (9421 octets)
client:	LIST
server:	+OK
server:	1 3020
server:	2 3201
server:	3 3200
server:	.
client:	RETR 1
server:	<The message headers (one line per line)>
server:	.
server:	<The message body (one line per line)>
server:	.
client:	QUIT
server:	+OK POP server signing off
client:	<release TCP/IP connection>
server:	<release TCP/IP connection>

Figure 3 - Example POP3 session

The sound of MIME

Two of the major limitations of standard Internet mail (and news for that matter) are that they can only use 7-bit characters in the

There is a lot of concern regarding the security of Internet mail, and rightly so

header and body of a message and there is no convention for defining the structure of the body.

The consequences of the first limitation are that binary information cannot be sent

as is and that foreign character sets cannot be used. Solving the second problem would allow the recipient mail application to know how the mail content should be presented to the user, eg as a video clip or a spreadsheet.

The Internet community has had a solution for the problem of sending binary for quite some time now: it involves using a scheme for coding binary data as a text file. The two utilities that manage the encoding and decoding are called, respectively **uuencode** and **uudecode**. The **uuen-code** program also provides a mechanism for splitting and reassembling long binary files into chunks that are more amenable to the Internet mail infrastructure.

However, the emerging standard for dealing with both of the current shortcomings is known as *Multi-purpose Internet Mail Extensions* or, more usually, **MIME**. This standard defines a means of identifying the content of the body of a mail message (as opposed to the header lines) so that it can be exploited by a MIME-capable mail application.

MIME is designed to be backwards compatible with the current scheme in that a MIME message can be sent over the current Internet infrastructure because binary data is still coded as 7-bit characters. MIME is often associated with the concept of multimedia mail but this is misleading as

Content Type	Description
application	For files that correspond to particular applications.
audio	For digitised sound.
image	Denotes a still-image.
message	Either for forwarding mail, sending messages that have been split or referencing a file not included in the message.
multipart	The message contains several parts, each part will be described by a further content type.
text	For text messages, although some basic formatting is allowed. Also foreign character sets can be used.
video	Combined movie and soundtrack clips.

Figure 4 - MIME content types

the content of a MIME message could be any sort of data. I suspect that the association has come about because MIME-compliant mailers know how to edit and view/play many of the message types and that includes firing-up graphics viewers, movie viewers and sound players. Indeed for a MIME-compliant mailer the association of a message type to 'viewer' is defined by a capabilities file that takes a form similar to the configuration of a World Wide Web browser as discussed in last month's article.

A MIME message identifies the type of message by the use of a new header line, **Content-Type**. Several different content types may be used in the one message. They are listed along with a brief description in Figure 4. These basic types are further refined by subtypes and MIME also allows for user-defined types.

A matter of privacy

There is a lot of concern regarding the security of Internet mail, and rightly so. The ownership and management of all of the components (ie backbone hosts and telecommunications media) of the Internet is spread wide and a mail message may pass through the 'hands' of many different organisations: a potentially disconcerting thought.

However an organisation concerned about the security of its mail messages while en route through the Internet can

I have no doubt that within a decade from now email will be more widely used than fax

take measures to keep out prying eyes. These measures are twofold: to implement end-to-end encryption of the message body. And to take steps to improve the security of access to the computers that actually connect to the Internet.

The latter measure is vital as there is no point in sending and receiving encrypted mail if a snooper can log in to the destination machine and read the decrypted message anyway.

There is a scheme running which allows two users to send encrypted mail, it relies on the RSA public-key encryption method, Pretty Good Privacy (PGP). This technique relies on using public keys to encrypt messages that can only be decoded

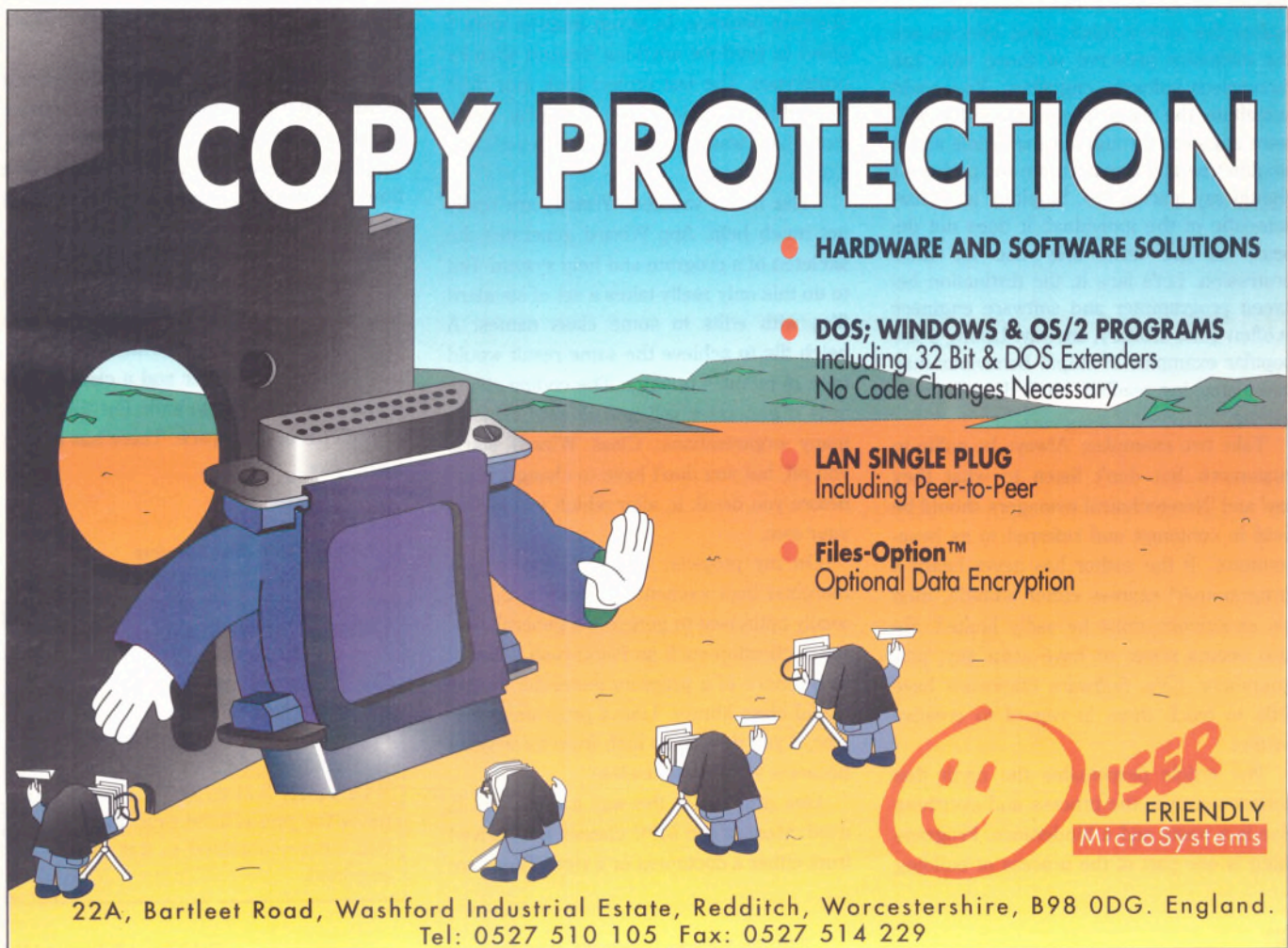
using a private key. Public OLE keys are made available through *key servers* which operate through mail addresses, the most convenient one for this country being pgp-public-keys@demon.co.uk. Try sending mail to this address with a subject of **help** for more information.

Gateways to other worlds

Finally, there are a number of gateways between the Internet and other sizeable networks or BBSs, which will pass mail between the two. Instructions for mailing between the Internet and some of the other important networks are given in Figure 2. The instructions are expressed in terms of the components of the destination address or 'addressee'.

I would like to give credit to Scott Yanoff who compiled much of this information. The full text of Scott's Inter-Network Mail Guide can be retrieved by FTP from [csd4.csd.uwm.edu](ftp://csd4.csd.uwm.edu), the file is `/pub/internetnetwork-mail-guide`.

Paul Richardson is a Director of Motiv Systems Ltd, a consultancy specialising in Open Systems, interoperability and the Internet. He can be contacted on 0223 576318 or by email at PaulR@Motiv.demon.co.uk.




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Unless your letter is marked 'Not for publication', it will be considered for inclusion in this section.

Soapbox flannel won't wash

Dear EXE, Soapbox (June 1994) would have been funny if it weren't so laughable. Oh, I don't say that the stupid behaviour described doesn't exist, but I can't imagine what makes the author think these idiocies are the exclusive preserve of those who call themselves software engineers. You could substitute the name programmer for software engineer throughout the article and it wouldn't be any less accurate (or perhaps I should say inaccurate). Stupidity is a characteristic of the individual: it does not depend on the term they use for their profession. Let's face it, the distinction between programmer and software engineer is often quite arbitrary, anyway. Listing a few popular examples of stupid behaviour may make amusing reading, but it doesn't prove a thing.

Take two examples; 'Always be polite to customers...but don't listen to what they say' and 'Non-technical managers should be held in contempt and referred to as bean-counters'. If the author has never heard a 'programmer' express either attitude, then his experience must be sadly limited. He also seems never to have seen any 'programmers' CVs. Software engineers have little to teach them in regard to creative writing.

The article perpetuates the myth that programming is the process and everything else is a waste and a hinderance. Programming is one part of the process of building

software systems. Tasks such as setting standards (and keeping them!), thorough analysis and design before coding, documentation and testing are every bit as important as coding. The failure to realise this is why the software industry continues to produce more disasters than successes, while it is a rare event for a bridge to fall down.

*Ian Cargill, CEng, MIEE
Software Engineer*

VC++, hell no!

Dear EXE, In the June issue, you reported an attack by the Butler Group on Microsoft development tools. Butler was highly critical of Visual Basic and Access. I also feel critical of Visual C++ and the Microsoft Foundation Classes, which I have had to abandon after several months work.

Apart from being forced into the bad practice of using macros in C++, I found the class library and the concepts behind it an absolute penance. In seven months work I failed to produce anything beyond sketchy prototypes. The last project took four days to produce a single screen of display. I estimate that I was achieving eight lines of code a day.

The much vaunted Wizards are really not much help. App Wizard generates the skeleton of a program and help system. But to do this only really takes a set of standard files with edits to some class names. A batch file to achieve the same result would take 10 minutes to write. The coding standards it generates will not be acceptable in many organisations. Class Wizard starts you off, but you don't have to change much before you break it, after which you are on your own.

On my projects, the MFC was only a marginal improvement on straight C. It is totally optimised to generate a general desk top application such as Paintbrush. I find it to be more of a program generator than a useful class library. Like a program generator, if you deviate an inch from its target it becomes worse than useless.

One problem is the way a document is used. Most of the MFC classes are derived from either a document or a view. These are

so tightly bound that a view cannot properly be used without a document. But the only way to create a document is via the common file dialog. If you are writing, say, an accounting program, this is the last thing you want. It prevents you from using most of the MFC classes in this type of application. I did manage to create a document without calling the file dialog, but it took me the best part of a week, painfully stepping line by line through the source of the MFC. I had to modify two undocumented classes.

This philosophy seems to pervade the MFC. Whatever you need to do, Microsoft has found a way to stop you. The simplest task takes hours. It is as if the channel tunnel rail link went straight to the 14th floor of Canary Wharf. Great if that's where you want to go, but if you don't you are well and truly on your own.

I have now switched to the zApp class library, largely because of a review in EXE in June 1993. It is a positive joy to use. zApp may not generate 10 skeleton files for you but the 'Hello World' program takes 29 lines of code, including braces. The library works.

We will all be hurt if Microsoft succeeds in driving out the competition. This magazine can do a great service in encouraging other suppliers of development tools. At the same time you should continue to criticise, I felt that Cliff Saran's comment last month slamming 'software that is bloated and hungry for disk space' was particularly apt. All I want is a C++ compiler and access to Windows. Visual C++ comes with a rotten editor, a modest debugger and a class library that I've been forced to junk. For this I lose over 60MB of disc space. There has to be a better way.

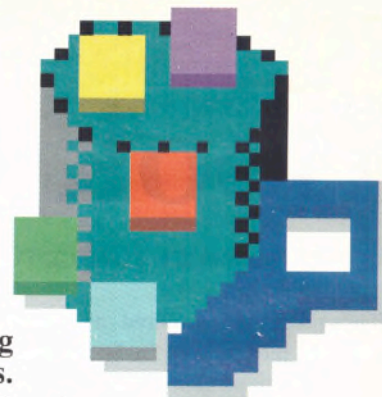
*John McMillan
McMillan Computing Services*

Letter of the Month

The writer of the best letter of the month, as judged by the Editor, will receive a £30 book voucher, courtesy of PC Bookshop, 21 Sicilian Avenue, London WC1A 2QH (071 8310022). The best letter is the one printed first. Please note that letters submitted to this page may be edited.

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Book Review

The Whole Internet User's Guide and Catalog, 2nd Edition Reviewed by **Edward Kenworthy**

Having recently acquired an embarrassingly fast modem, I've finally got around to subscribing to CIX (ekenworthy@cix.compulink.co.uk if you're interested). The Internet is something you can't possibly have avoided hearing about, whether through the BBC's much sanitised *The Net* or as part of some electioneering politicians' scare-mongering about the spread of pornography.

Having bought my ticket for cyberspace I spent several days looking through the vast lists of conferences available, until I noticed one in particular: USENET. This apparently, is a gateway into the Internet newsgroups. The next thing I knew I was up to my neck in WWW, ftp, gopher, WAIS, telnet and god knows what else. I needed help, and where better to ask for it than on the net itself? The consensus of the replies I received was that *The Whole Internet* by Ed Krol was the best guide around, so off I went and bought a copy, for real money!

The Whole Internet is very much a beginner's guide to the Internet, which is just as well, because that's exactly what I am. The first few chapters introduce the net, it's history, the rules about commercial usage and so on, as well as what is and isn't al-

lowed on the net - and why. This for me was probably the most generally useful part of the book as it gave an important insight into a whole new community - one which I hoped to become a part of. In much the same way that it's probably a good idea to read up on Japanese culture before going to Japan, it's a good idea to know something about the Internet's culture before joining in. You don't want to upset people and be 'flamed' (sworn at) for saying the wrong thing in the wrong place.

After this introduction to the net's culture and how to avoid committing some awful faux-pas, Krol introduces some of the tools that allow you to actually use the net. He shows how to 'ftp' to access those gigabytes of data. Well, giga is probably several orders of magnitude too small, but you get the idea. How to find that file, or even those files, on green monkey disease using 'gopher' to 'go-for it' (I know, I know) and how to use the World Wide Web (otherwise known as WWW or W3) to navigate pages of hypertext information to find the particular paper you want. Krol covers all of the tools for accessing the net that you could possibly ever need - which is a real god-send. And as the book was written over the

net you can be sure that Krol is a practitioner and knows what he's talking about.

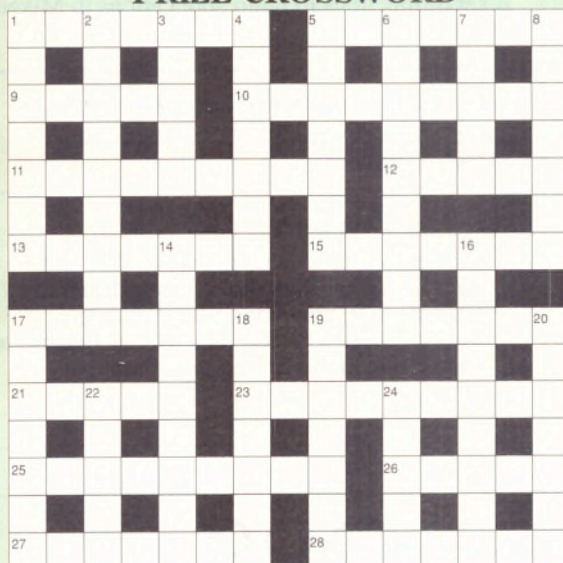
Krol also provides information on how to get connected to the net as well as some basic trouble shooting. The concluding section is a quick start catalogue to ftp sites, divided by subject - which are very useful as a starting point in any search. Green monkey disease not listed - well how about trying one of the biology or medical sites and going on from there?

'The Whole Internet User's Guide and Catalog' is one of the most well written, informative and easy to read technical books I've read or reviewed in a long time and, if you have any interest in the Internet at all, then I can't sing this book's praises loud enough.

Verdict: Highly Recommended

Title:	<i>The Whole Internet User's Guide and Catalog, 2nd Edition</i>
Pages:	543
Price:	£18.50
Author:	Ed Krol
Publisher:	O'Reilly & Associates Inc.
ISBN:	1-56592-063-5

PRIZE CROSSWORD



ACROSS

1. Organise the pass, but not on time (7)
5. Density of 17 down in a channel (7)
9. Chunk of wood and a chip: digital basis (5)
10. I/O units at the end of the line (9)
11. Plot a two-bit start in the machine (9)
12. A king and successor have burning desire (5)
13. Chooses the chosen few somehow initially (7)
15. Busy programmers on hills round French island (7)
17. Smart programming, structured neatly (7)
19. Brown male going off the edge (7)
21. Sounding huge, but may jar (5)
23. Aristocratic transport mechanisms at the end of the ball (9)
25. An entity's is in a field (9)
26. The first semi makes chunks of data... (5)
27. ...and long sets of characters (7)
28. Verses devilish for upsetting people (7)

DOWN

1. There often were eighty (7)
2. 9, friend: you know it makes sense (9)
3. Ubiquitous US code (5)
4. 'Pest ran wild and catches the bug (7)
5. Hill intended, I hear, to be agony (7)
6. On screen action (9)
7. Sentinels that fly to warn us (5)
8. So, I scan the chaotic gaming like pine (9)
14. Centre of a condition (9)
16. Always keen on the environment like pine (9)
17. Indications of data transfers (7)
18. Glitches in the gorge?
19. Objects of a search (7)
20. Somehow with a tic, Tess checks the chip (5,2)
22. Make amends at the church centre, I hear (5)
24. Amin to return a fool (5)

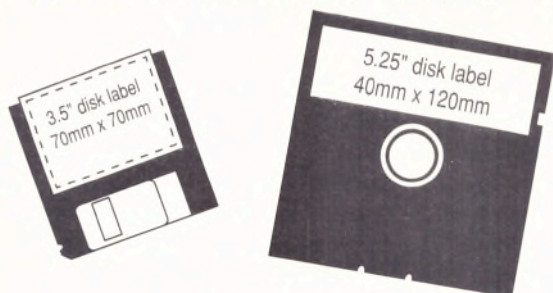
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**PRIZE
CROSSWORD
is compiled
by Eric Deeson**

August's prize is Microsoft Encarta, the definitive 29 vol multimedia encyclopedia. Please send your solutions to EXE Magazine, St Giles House, 50 Poland Street, London W1V 4AX. June's winner was Mr T. Collins of Epsom, Surrey.

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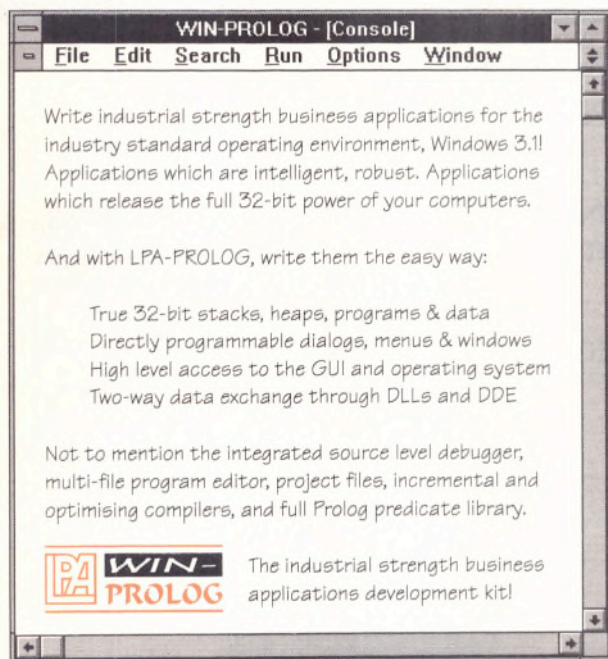
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Be skillful. Be very skillful

Les Peck explains why
it's well worth investing
hard cash and your valuable
time in good training...



'Contracting' is a marketing activity. To stay in business, a contractor has to sell his product; be it software, training, writing or consulting. But for the best results, it should be something that is in demand.

Agreed, there always seems to be a market for the older languages - like Cobol or Fortran - but the future lies in keeping up to date.

Right now, the big demand is for Visual Basic. For what it's worth, the agency requirements for VB people have increased by around 1000% since April. In fact, VB has grown so fast that it now has its own user group and its own magazine. Other products also in demand include Access, Clipper and anything to do with dBASE. So anyone who is thinking of upmarketing their skills should work along these lines.

But how? Well of course, there's always for-

mal training. Any number of schools and similar organisations advertising regularly in the trade press can teach you what you want to learn. But this can be a problem. When in work, there isn't any time - and when the work dries up, it's hard to justify the £1000/week or more unless there's something coming that will cover the investment. However, if you decide to use the training school approach, you can bet your mortgage that as soon you've paid your deposit, a contract will arrive to fill that time slot.

But there are other ways to learn a product. For example, all you need for VB development is some knowledge of Access, SQL and a little imagination. In other words, most of the modern GUI packages have grown out of something else. If you can handle one, it shouldn't take you too much effort to learn another.

Anyone with Access skills can upgrade to VB. First buy it, then, and most importantly, remember to use it. The same holds good for any other package. If you go for 'DIY', there is plenty of help available. A number of companies have produced a wide range of training

material on video. As an example, Softvision will sell you a reasonably-priced VB trainer - and most of the other suppliers are just as good with their material. Tapes, of course, mean training flexibility. For contractors, they allow the self-teach learning curve to fit the time available.

So where can you get hold of all this information. Hold on a sec...You've got it in your paws this very moment. EXE and other computer press carry a wealth of software information. Often I can simply find what I'm looking for by reading the adverts. Otherwise, most of the major distributors have some kind of Help Desk. Call 'em up and ask for their advice.

Yes it's true: good training costs money. But it's cash well spent. If you want your services to be competitive you have to be in a position to offer what the market needs. Teaching yourself the ins and outs of new products is a sure way to keep ahead in this ever-changing world of software development. If you think of every pound on 'training' as another thousand in the bank, it won't be half as hard to sign the cheque.

RETURN TO IRELAND

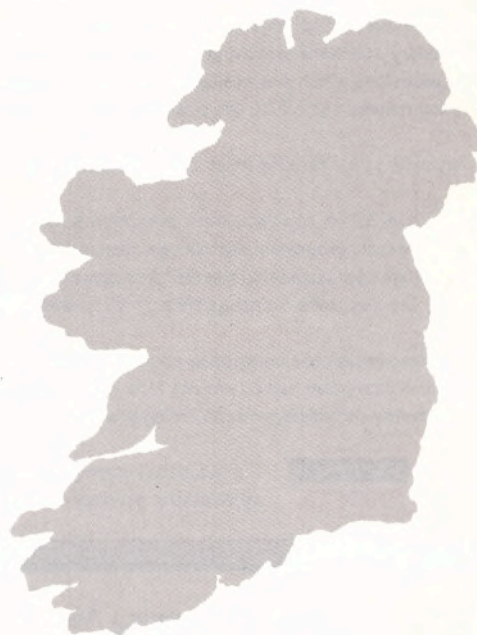
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A/P	UNIX, C, PASCAL (Grad or Junior)	£13k
ANALYST	ANY PLATFORM, INSURANCE KNOWLEDGE	£22k
TECH. MGR	ORACLE 6, FORMS 3, SQL, PL/SQL	£22k+

CONTRACT

A/P's	OCL COBOL, IDMS, TPMS (4 jobs)	3 mths	C191
A/P's	VISUAL C++ ACCESS, or any RDBMS	3 mths	C192
A/P's	AS/400, COBOL, APPC (nice to have)	6 mths	C193
A/P's	C, ESQ, POWERBUILDER	6 mths	C194
A/P's	SYNON/2 - ALL AREAS OF USA (10 jobs)	6 mths	C195

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SOFTWARE ENGINEERS

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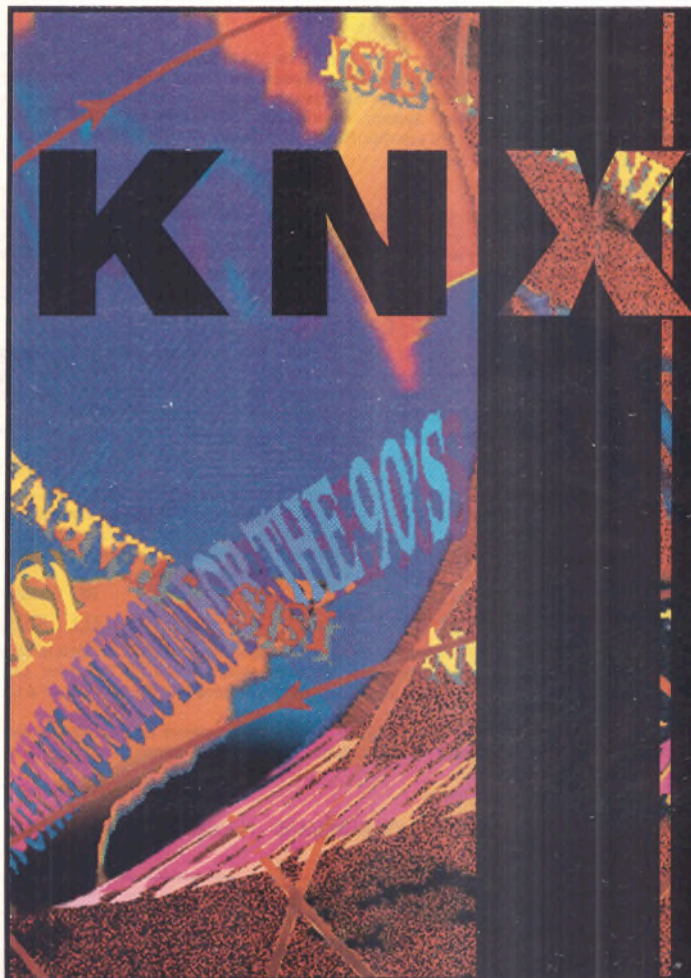
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Write, enclosing a full CV to:

The Software Manager
TESA METROLOGY LIMITED
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REF SC/02/EXE

UNIX / VMS / MS WINDOWS

ALL LEVELS

A degree in computer or natural science, 2 years solid C programming experience and a sound understanding of UNIX, VMS or MS-DOS are required to work on large scale programs with user interaction. You will need an intelligent problem solving approach to work and be a quick learner to programme software in an X-Windows, Windows SDK or NT environment, port software to different systems and liaise with customers to drive through product improvements. Excellent career opportunities for the right candidates.

£16 - £28,000

REF SC/03/EXE

C / C++ / VISUAL BASIC / UNIX / MS-DOS

DEVELOPERS

Software House and End Users in Finance, Banking, Manufacturing, Commercial, Scientific and Government application environments require excellent C skills. Both Windows development skills W/3, SDK, NT, X - Windows and Visual Basic or strong C, C++ solid operating systems and good application knowledge are again much in demand. Software development experience is the key, and being able to deliver high performance, high quality, well specified software in competitive time scales. Opportunities vary from small to large software companies involved in expert systems, GUIs, Image Processing, GIS, EIS, Communications, Networking and Object Orientated Databases. Graduates through to senior software engineers / team leaders are required. Please call to discuss.

£14,000 - £35,000

REF SC/04/EXE

INGRES / ORACLE / SYBASE

ALL LEVELS

Additional experience of: SQL, Forms, C and other 3GL languages are also of interest. We currently have client companies including Management Consultancies, Systems Houses, Systems Vendors, Bank and Finance clients looking for candidates with: Relational Database Design, Database tuning, Systems Administration, DBAs, Pre/Post Sales and solid programming knowledge and expertise. Please call to discuss your particular requirements.

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REF SC/05/EXE

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C/06/EXE

UNIX / MS - DOS / VMS / C AND C++

ANALYST PROGRAMMER

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£17 - £25K + Banking Benefits

REF SC/07/EXE

WINDOWS 3.1/X-WINDOWS BANKING

ALL LEVELS

3 city clients require windows skills at any level. Other relevant skills are SQL server, Transact SQL, UNIX, VMS or MS-DOS, C, C++, Open Client (DB and Net library) Open interface and APT. Exposure to analysis, developing user interfaces and rapid development techniques. Full training in Middle Office / Production and Front Office Systems including: Financial and Management Accounting, Treasury, Equity, Fixed Income and Derivatives.

£20 - £25K + Banking Benefits

REF SC/08/EXE

OOD / OOP, C, C++, VISUAL C++

ALL LEVELS

As the market for Object Orientated skills gathers pace we have a number of clients designing systems in diverse application areas including: Multi-media, DTP, Telephony, LANs, Electronic publishing, On-line Information Feeds, Finance and Banking in both a UNIX and DOS environment.

Positions available vary from traditional Programmer / Software Engineer and Analyst / Programmers to Designers / Senior Software Engineers in the overall strategic direction for end-user organisations

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REF SC/09/EXE

VISUAL BASIC SKILLS MUCH IN DEMAND - PLEASE CALL TO DISCUSS



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JOB C++/MS-WINDOWS		JOB SDK/'C'/MULTIMEDIA		JOB C++ / MS WINDOWS	
LOCATION CAMBS.	SALARY £18-24K	LOCATION West London	SALARY To £20K	LOCATION Berks.	SALARY To £28K
Dynamic Software Engineers are required by this fast-growing Multimedia company. Suitable candidates should offer experience of programming in Borland or Visual C++ under MS Windows. Experience with Multimedia systems, whilst an advantage, is not essential. More importantly, candidates should be bright, enthusiastic individuals who enjoy learning new skills. Working in a small development team, the successful candidates will be liaising with other departments, so good interpersonal skills are essential. REF:EXE 19		An expanding developer of Multimedia titles, our client is looking for two Analyst Programmers. The main criteria is a minimum of 12 months' SDK and 'C' experience. If applicants have also developed query tools to access any of the leading PC database engines or have any Multimedia/CD-ROM exposure then this would be of added interest. Successful candidates will be involved in whole project life cycles and will be using the latest development tools. REF:EXE 21		A leading and rapidly expanding developer / manufacturer of laser scanning systems is looking for three Software Engineers with strong C++ skills. Candidates must have in excess of 12 months' C++ experience (gained on a significant project), backed up by a good knowledge of MS-Windows programming. Any CAD / CAM or 3D Visualisation experience would be advantageous, but is not essential. Challenging development projects and highly competitive salary packages are on offer. REF:EXE 23	
JOB VISUAL BASIC/ORACLE		JOB 'C' / UNIX / GUI		JOB C++ PROGRAMMERS	
LOCATION City	SALARY To £32K	LOCATION Surrey	SALARY To £18-26K	LOCATION Herts.	SALARY To £30K
Our client, a leading City based financial institution, is about to undertake the development of GUI front ends to their existing systems. The ideal candidates for these positions will have strong 'C' / UNIX and Oracle skills, coupled with recent programming experience in Visual Basic. Successful candidates will have the opportunity to work on a variety of projects ranging from Equity to Accounting Systems, while enjoying an excellent team orientated working environment. REF:EXE 20		Having just moved to impressive new offices, our client is seeking five Analyst Programmers to work on the development of their networking and communications products. Candidates should have a minimum of 2 years 'C' and UNIX design and development experience and, preferably, have some familiarity with XView, Motif and/or X. Our client is committed to offering their staff excellent opportunities for career development and, therefore, candidates demonstrating management potential will be considered for future team leading positions. REF:EXE 22		These vacancies will appeal to dynamic, young software engineers who enjoy working in a product development environment using the latest Windows technology. Our client, an expanding company, is currently developing its next generation of terminal emulation products and is therefore seeking high calibre Developers. Suitable applicants should have excellent MS Windows / SDK experience along with a fluency in 'C' or, preferably, Visual C++ / MFC. Excellent salaries are on offer for talented individuals who enjoy a challenging development environment. REF:EXE 24	

CONTRACT VACANCIES - UK WIDE

City Sybase SQL Server 6 months		City Windows NT Developer 6 months		City Visual C++ Developer 3 months	
Surrey Oracle 6 / Forms* 3 Programmer 6 months		Middx. Windows NT / 'C' Programmer 6 months		W.London Visual C++ Programmer 3 months	
London System Tester 6 months		W.London MS-Windows / SDK / 'C' Programmers x 3 3 months		S.London VB/C/SQL Analyst Programmers 6 months	
City INGRES ABF DBA 3 months		Herts MS-Windows / Btrieve Programmer 3 months		S.London Borland C++ / Multi-Media Soft. Eng. 3 months	
City GUPTA / 'C' Consultant 6 months		City MS-Windows / Banking Consultant 6 months		London C++ / Multi-Media Developer 3 months	
Herts Embedded/Real Time Systems Developers 3 months		Surrey Device Driver / Windows Soft. Eng. 3 months		City Visual Basic v3 Programmer 6 months	
City OS/2 / PM Programmer 3 months		Berks. Windows Testing Soft. Test. 3 months		London Visual Basic & C++ Analyst Programmers 6 months	
Middx. Exel 5/Macro Programmers 2 months		Surrey X-Windows / 'C' Soft. Eng. x 2 6 months		City Visual Basic / MS-Access Programmer 6 months	
W.London 'C' / DOS Programmer 3 months		London Windows/C++ Project Leader 6 months		Surrey Visual Basic / SDK / 'C' Developer 6 months	
REF:EXE / 25		REF:EXE 26		REF:EXE 27	

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Kamikaze Ken, Editor of EXEnders: Data-Liberator...

Well, here we are again folks, back with another nail-biting episode of the first, last and only Software Development Soap Opera. The camera pans through the hustle and bustle of a busy office, positively humming with activity. Not that it ever manages to hum quite as much as Mike from Advertising's socks. Recent statistics show that thanks to Western Capitalism's fervent struggle for World Domination, even little known tribes in the furthest reaches of those rapidly shrinking rain forests are now fully aware of the anti-social nature of a sock that has been closeted (*avec* foot) in a designer trainer on a long hot sunny day. This, dear reader, is by way of being an introduction to the topic of health, safety and the general mental well-being of the EXEnders staff, that is the theme of this episode. It's a kind of analogy I guess: Because you, I and the rest of the world know that there is nothing healthy or safe about socks that spend any amount of time in trainers. And the same is pretty much true of the EXEnders office. 'Healthy' and 'safe' are two adjectives that few would employ in any descriptions they may have been asked to give. 'A comprehensive and gruelling test of strength, integrity and tenacity' maybe. But unless you'd recently emerged from a two-week research project at Chernobyl 'healthy and safe': probably not.

Not that this bothers our hardened team of workers at EXEnders: the guerilla soldiers of the IT world. Taking inspiration from their forthright leader Kenny Lydon (known as Kamikaze Ken in the trade) - editor and urban warrior. As he strides through the office on his way to another Power Pizza, he can be heard to chant reassuring war-cries to his staff. His favourite being 'Back up? Bog off!'

'There's nothing quite like the thrill' he claims, 'of living life on the knife-edge. Never knowing whether the next key pressed, the next button clicked could result in a major breakthrough or the loss of the past year's work.' He's been known to induce tears of admiration from even the most seasoned of staff, as he urges them to join his mission to 'Free the Data'. It's his proud claim that he's liberated more bytes in more countries worldwide, than any other Info-Freedom Fighter.

It's a fools game of course. Oh many may try it. 'I can handle it' they bluster. 'I know where the F12 key is, I just don't wanna use it right now, that's all.' But to Ken's way of thinking it makes no difference. Yes indeed: EXEnders is about to break to you, the big IT secret, the Gospel according to Ken. The Great PC Swindle. Ken believes, you see, that all that guff about PC's needing an operating system just isn't true. Well... OK, so they need an oper-

ating sytem to make them do what you want them to. But that's because they've already been programmed: to wait until the precise moment (estimated by a complex series of algorithms) at which it will inconvenience and baffle you most, and then crash. A conspiracy theory par excellence. Secret government statistics hacked by Ken's mates show that were it not for 'Agent Downright Bloody Irritating' as the dire plot is known, unemployment figures would be doubled, because everyone could do their jobs in half the time.

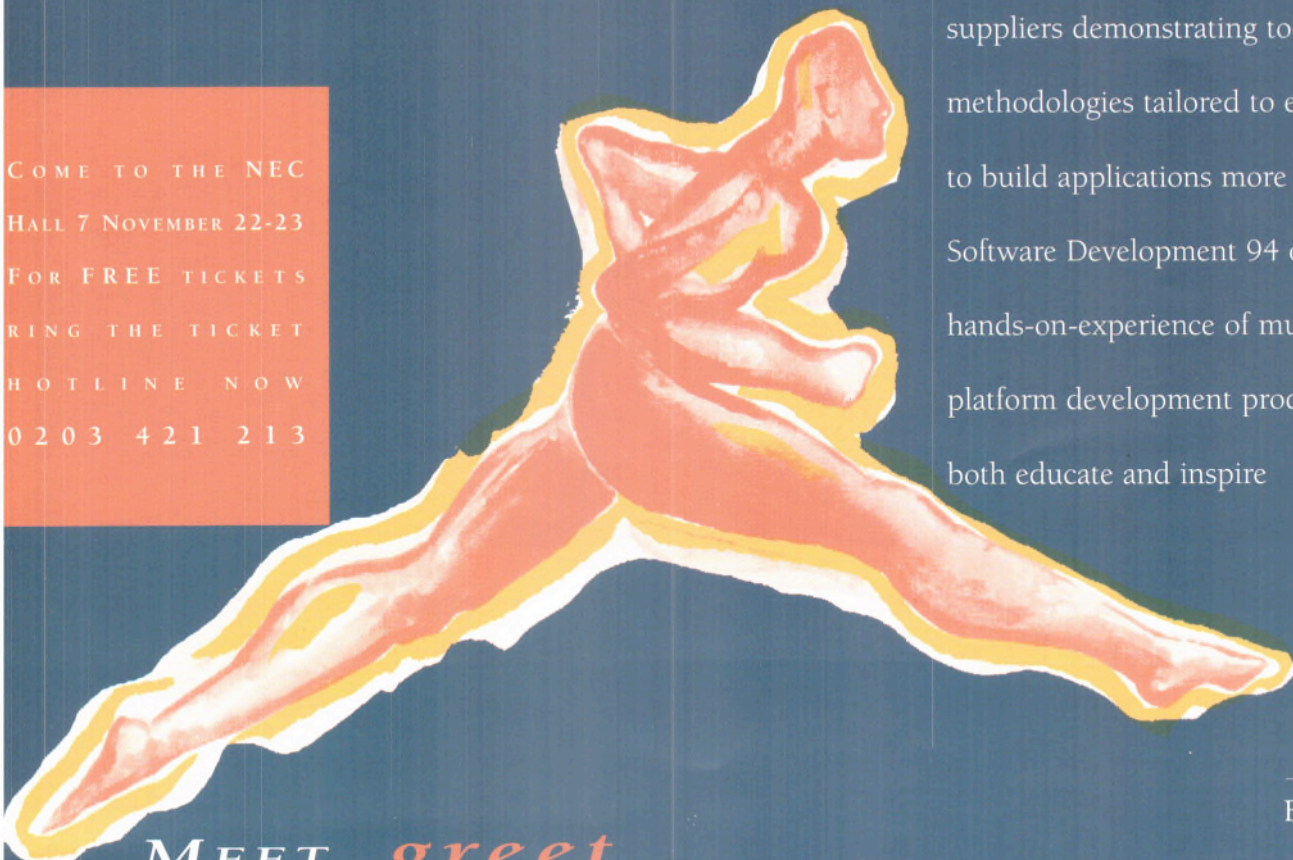
Which is why everyone at EXEnders likes to live life to the full: knocking the sytem from within. Ken's just come up with a super-doopah new plan to express staff unity and blatant disregard for mortality: he's having water sprinklers installed. Conveniently positioned, one above each PC. So that should any kind of fire break out, each member of staff can rest assured that he or she will also expire with their beloved mini-nuclear-reactor (without whom life would be worth nothing anyway). Sort of like a Viking Funeral or Suttee I guess, except with more blue sparks and convulsions. But, as Ken philosophically points out: 'If you've gotta go, you might as well make it interesting'. Right on.

M

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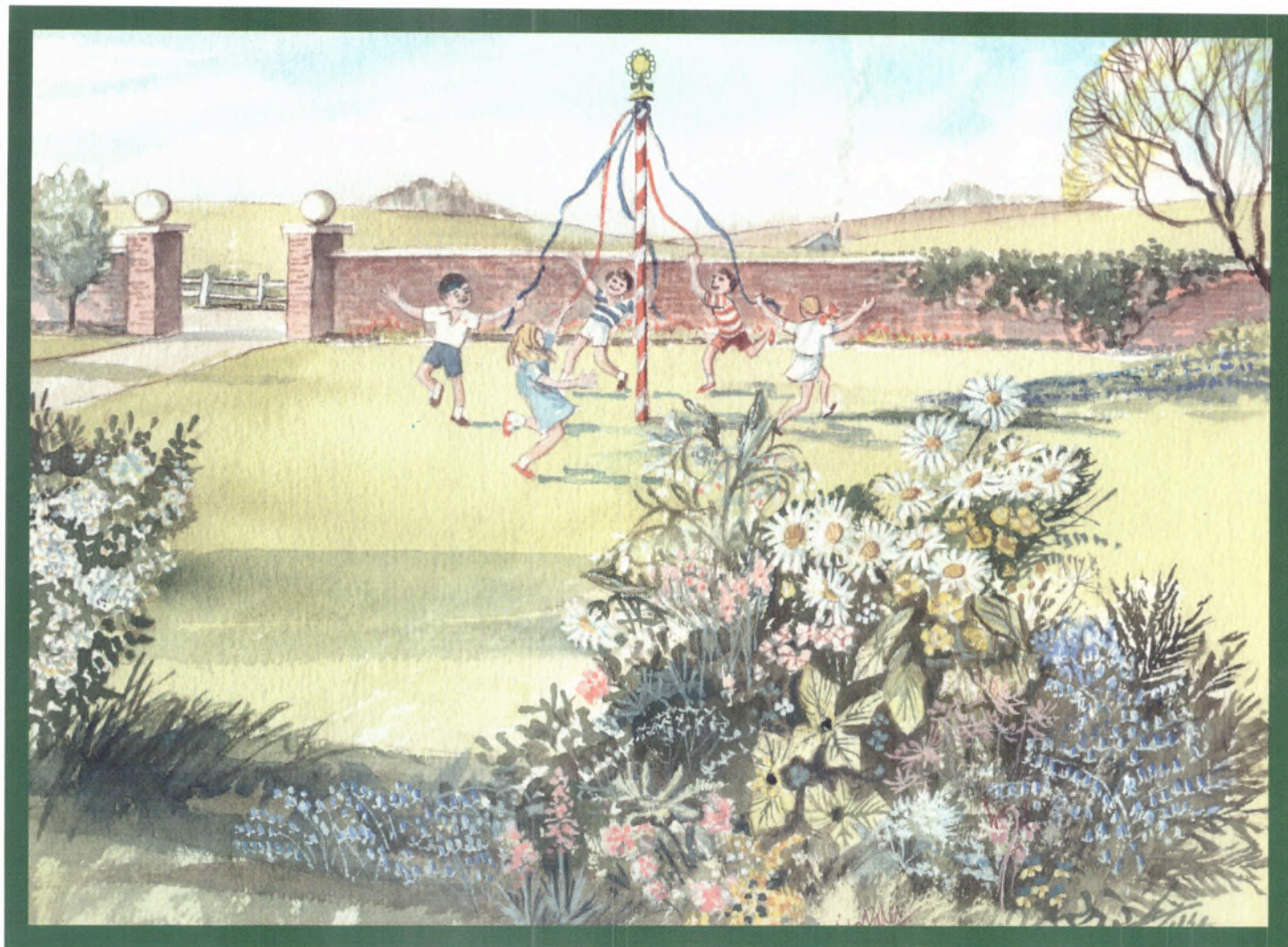
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